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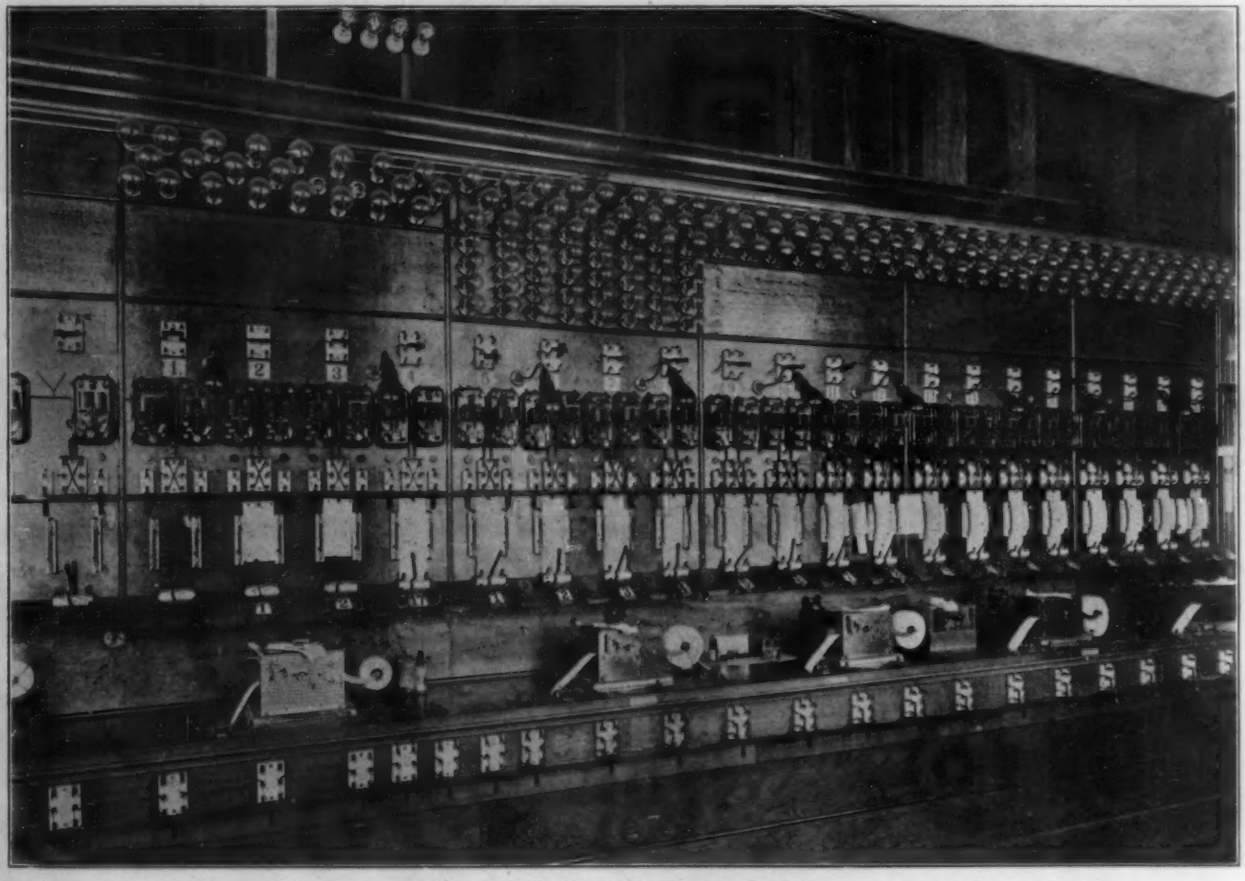
A MODERN FIRE SIGNAL SYSTEM

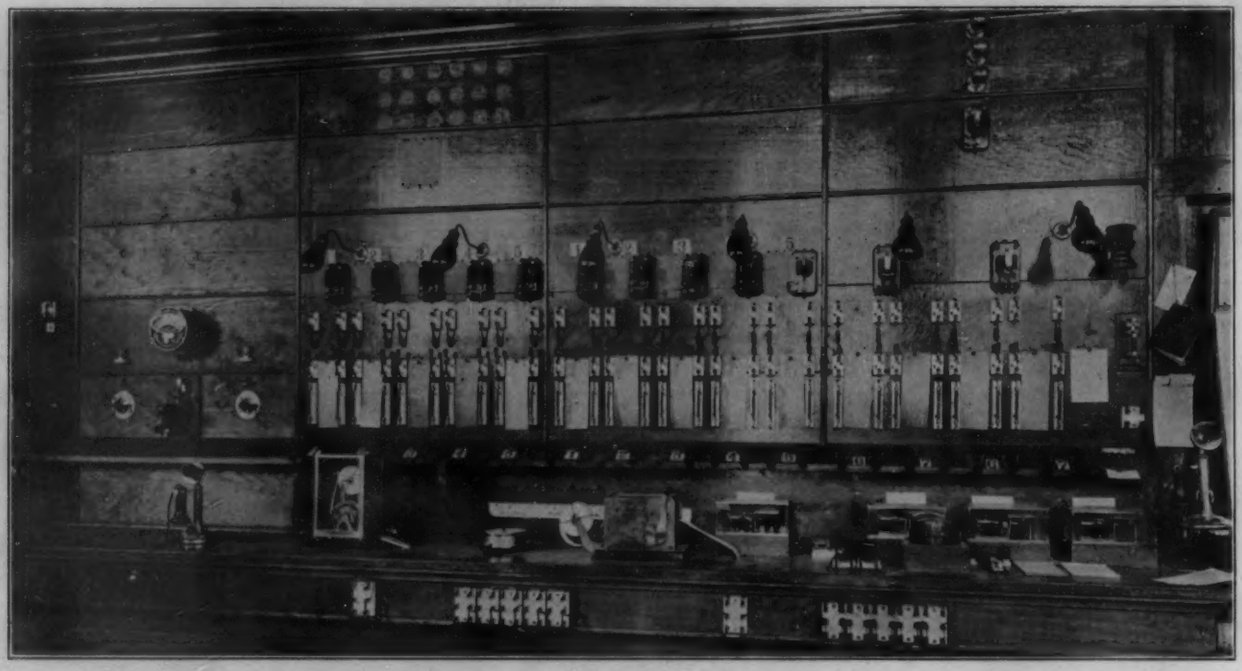
As few people understand how an alarm for fire is received and handled, a brief description of the operation of the system in use in the city of San Francisco may prove of interest. This is an important part of the work done by the Department of Electricity which has invented many improvements and which makes all of the apparatus it uses.



Receiving Switchboard for Fire Alarm Signals.

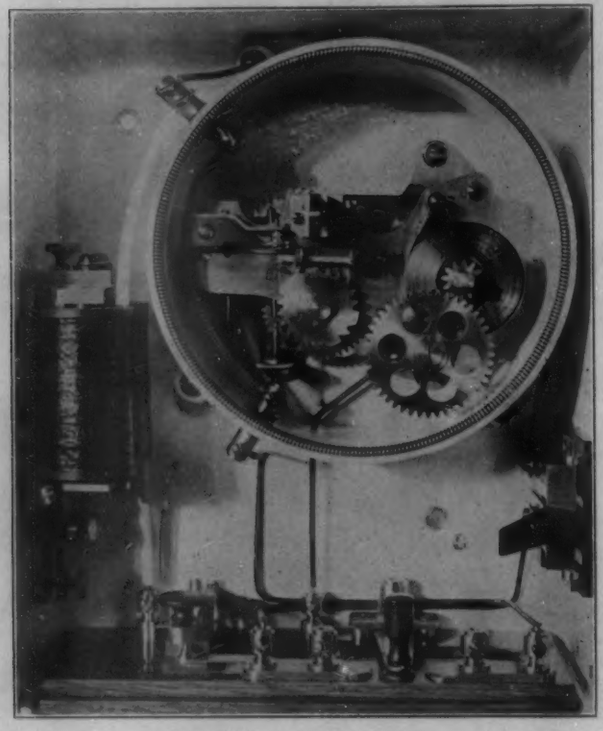
As is well known, fire alarm boxes are installed at convenient street corners throughout the city. By breaking the glass in the front of one of these boxes a key is exposed and used to open the door, thus exposing a hook which is pulled down to send in an alarm. In a few minutes the fire department arrives on the scene ready for work. Just what happens to produce this effect is a mystery to most citizens.

By opening the inner door of one of these boxes it is seen to contain a Morse telegraph key and relay, a shunt switch, a ground switch, and a spring operated gear mechanism which drives a small character wheel having absolutely no electrical connection with the line. Pulling the hook starts this mechanism in operation and causes the character wheel to make four complete revolutions. This character wheel is cut with gears corresponding to the number of the box, a different



Sending Section of Fire Signal Switchboard.

wheel being required for each box. For example: box 327 has a character wheel so cut that there are three teeth and a blank, two teeth and a blank, seven teeth



Interior View of Fire Alarm Box.

and a blank. These teeth give an alternate make-and-break contact with a brush connected to the wires leading to the switchboard at the central fire alarm office in the building occupied by the Department of Electricity.

This switchboard consists of a receiving and a transmitting section. The receiving wires are connected to a Morse key and to an automatic register which records the number as a series of dots and dashes. The operator in charge catches the number by ear from the Morse sounder and on receipt of the second round, to confirm the first, immediately repeats it with his master key which is connected to every fire house in the city.

The first blow on the master key automatically releases every horse in the department, strikes all the tappers and at night lights all the engine houses. By the time the horses' collars have been snapped into place, the whole number has been received and the company knows whether it is an inside or outside alarm, that is, whether it is within or without the district to which they go on a first alarm. Subsequent alarms are put in by the fire chief by means of the Morse key in the box.

There are nineteen box signal circuits throughout the city, seventeen being overhead lines connecting 460 boxes and two underground connecting 27 boxes in the main business section. The overhead circuits are mostly No. 12 copper wire with triple braid weather proof insulation and strung on glass insulators. Wherever possible they follow the telephone and telegraph lines, keeping off the power lines, though all boxes are so wired that a hot cross grounds the box without burning the coils. Independent pole lines are used to reach the outlying sections.

The underground circuit, including a 21,000 ft. length now being laid in Market street, are of 40 wire lead armored weather proof cable. All these circuits are interlaced so that nearby boxes are on different lines. An accident to one does not prevent an alarm being put in from another box close by.

Connected to the sending board are fourteen circuits, ten overhead and four underground. These are respectively, five overhead tapper, five overhead alarm, two underground tapper and two underground alarm circuits.

All lines are brought into the building through underground cables, two caring for the overhead system and one for the underground. These cables first pass to the terminal board in order to clear the office for test and to clear the inside fuses. Thence they pass to the main receiving switchboard made up of 19 panels, each of which is equipped with a double pole double throw knife switch for connecting to either the regular or the spare set; a double pole double throw pole changing switch connecting with the storage batteries; two single pole single throw ground switches; two fuses; two Morse keys and a double throw single pole switch for the galvonometer test for grounds.

There are always two operators on duty at the switchboard, working in three eight hour shifts. There are also three shifts of telephone operators, direct telephone connection being provided to each engine house as well as to the central offices of both telephone companies. These, together with a trouble man insure a minimum of at least four people continuously on duty.

There are three independent power sources for operating the system, two sets of storage batteries supplied with direct current at 110 volts from either the city mains or from a motor generator set in the office and one set of type Q and R Edison batteries. There is also a gas-engine-driven generator to be used as a last resort.

As already stated all the instruments used in this service as well as all switchboards installed at the engine houses are manufactured on the premises in a well equipped machine shop.

The Department of Electricity also takes care of the police boxes for the Police Department. Another important branch of its work is the inspection of all electrical installations in the city, the department approving all specifications, giving certificates of inspection upon the payment of a nominal fee.

Though somewhat handicapped in point of numbers, the department annually inspects from ten to fifteen thousand jobs, its revenue being from $15,000 to $20,000 per year. The department has been an important factor in recommending and enforcing rigid inspections and now suggests that conduits be installed in all public buildings, hotels, apartment houses, moving picture houses and theaters in the city, whether within the fire limits or not.

From the foregoing it is seen that the Department of Electricity is the nerve center of the fire department, all of whose movements are under the control of the electrical operators just as a railroad system is under the control of the chief dispatcher, The executive, head or chief of the Department of Electricity, is Wm. H. Urmy, to whose courtesy we are indebted for the details in this article.

Examination for electrical assistant is announced by the United States Civil Service Commission on November 9, 1910, to fill vacancies as they may occur in any branch of the service. The examination will consist of practical questions in electrical science, practical questions in construction and installation of electrical instruments, training and experience.

NOTES ON DISTRIBUTION POLE LINES.[1]

BY J. C. LAWLER.

Pole lines for distributing light and power seldom receive the attention they should during their construction. This is not due to lack of interest but more to habit—we feel that a line close to the distributing plant is subject to frequent inspection, and any impending trouble can be repaired before serious damage is done.

The distributing pole line is certainly as important as the transmission line. While an interruption to service on a faulty distributing circuit may not cause inconveniences over such a large area, the damages are likely to be greater. We have not only the faults of our own lines to contend with, but other lines may be the indirect cause of one or more deaths with resultant heavy damages. The distributing circuit is not only subject to greater liability to interruption of service from accidents, but the permanency of its location and its reputation for beauty is at the mercy of the public.

Unfortunately, there has been but little improvement in the material for pole line construction, and that which has been placed upon the market is generally mechanically weak in itself or cannot be properly supported. Most of us are still using two separated wires for services when duplex would present a decided improvement, if we could only attach it to a house so it would stay and not pull a weatherboard off or pull out and leave a hole large enough for an attic window. If some genius would only design an insulator suitable for services at the pole so that an inspector on the ground could tell whether the house was connected or disconnected. We need a tree insulator suitable for all sizes of wire, something that will not hurt the tree nor the wire—something cheap—and we need a self-supporting pole, because we do not always have room for stubs nor anchors, and a thin, light weatherproof insulation that in its old age will withstand the primary voltage when crossed with a telephone wire. But, unfortunately, we must do the best we can with the unimproved material and our own home-made devices.

The National Association has done considerable toward standardizing pole-line apparatus. Braces, cross-arms and pins are all being manufactured in standard sizes. Insulators are not standard, and if we could decide upon a certain few types of insulators that would be satisfactory for various voltages and sizes of wire it would not only tend to reduce the price but would give us more prompt shipment and the manufacturers would feel safe in making and stocking up on those types.

For the ordinary 2200 volt line, a porcelain insulator with a groove and a saddle each large enough to carry an insulated conductor of 400,000 cm. cable is satisfactory for practically all distributing circuits. The large groove calls for an insulator large enough for a 4000-volt arc current and is mechanically strong enough for heavy service wires, and yet if we glance through a catalogue of insulators we find several types for 2200 volts, and it is impossible to get better than four months' delivery on any of them.

[1] Paper read at Eighth Annual Convention Colorado Electric Light, Power & Railway Association.

The writer does not believe in building cheap lines. How often have you planned on extending your lighting circuits into a new territory and find that the income does not warrant the expense? And yet you feel that by extending the lines you help to develop the territory and will ultimately have an increased paying business. No doubt you will build, but do not do it at the sacrifice of the pole line. When you increase the length of your spans you increase the maintenance of your lines. For ordinary construction, spans longer than 125 ft. should not be used, and 100 ft. is preferable. Assuming that a residence block is 400 ft. long and is made up of eight 50 ft. lots, and the lots all abut on an alley. If you place poles on lot lines 150 ft. apart you will have trouble sooner or later in getting service wires to your consumers. The erection of barns and other structures on the back end of the lots will not only be obstructions, but quite often one consumer will complain if another consumer's service is over his property. Telephone companies can afford to install 200 ft. spans in new territories, and then place poles half way between when the territory becomes more thickly populated, but when we are limited to 150 ft. spans, any additional poles would give us too short a span and would also bring the poles in the center of a lot. It then requires the rebuilding of a line, the expense of the same going into the pole-line maintenance account in place of being charged against the income of the original consumers. When the income will permit the building of a cheap line, it will generally permit of the building of a good line, if all the expenses are calculated. In building lines, it pays to have careful surveys made.

Poles should be placed upon lot lines extended.

When in alleys, the center of the pole should be about two feet from the property line, which will prevent a four-pin cross-arm from extending into the property.

Lines should be built in alleys as far as practical in order to supply rear feeds and prevent the necessity of services crossing the street.

Lines, when placed on street, should be sufficiently inside the curb line to permit the building of a curb or ditch box.

Poles should be straight, well in line, and painted; a neat-looking pole line helps your standing with the community.

Galvanized hardware is preferable. Above all, do not use brackets, nor permit other companies to use brackets, on your poles. Brackets cannot be regularly placed, and they will not stay on. They are a menace to linemen as they do not allow room to work and endanger his life.

The writer has found that a cross-arm to be mechanically strong must be at least 3½ in. by 4½ in. In order to allow the lineman room to climb a pole between conductors, a 28 in. space or more must be left. When the center space is 28 in. with pins 12 in. apart and 4 in. between the end pin and the end of the arms, it will make the arms of the following length: 2 pin, 3 ft, long; 4 pin, 5 ft. long; 6 pin, 7 ft. long; 8 pin, 9 ft. long.

Cross-arms are cheaper when purchased in even foot lengths. The National Electric Light Association standard is 14 in. pin centers, but the difference in price warrants the use of the 12 in. spacing.

It may be advisable to step transformer poles, but when steps are used, the lowest step would be 7 ft. from the ground, in order to prevent the small boy from climbing the pole.

No. 6 wire has undoubtedly been found to be the smallest allowable, on account of mechanical strength. No. 8 is preferable for service wires, as it throws less strain on the house brackets. Each house in a residence district should have its individual service wires. When the house is disconnected, the service can then be disconnected at the pole and the service dropped from the insulator down around the pin. This permits your inspector to determine as to whether or not a house is connected. The system of running a bus bar arrangement on the back of the houses invites the occupants to connect themselves, then you not only lose the income but lose the current.

It is important that a transformer record be maintained, and maps showing the lines. The following system has been adopted by the writer, which has proven effective.

The maps are drawn on the back side of tracing cloth, each circuit being drawn separately and shows the location of lines, the position of the conductor on the pole; certain signs are used showing the location of lightning arresters, size of wire, location and number of transformer, etc. The map also indicates the ownership of the poles and shows whether or not the line is primary or secondary. These maps are cut in sections about 10 inches by 12 inches, and kept in book form. The tracing permits blue prints to be made, and the transformer numbers are written in lead pencil to facilitate erasures. The small sections make the map easy to handle, and obsolete sections can be replaced without redrawing the whole map. A transformer record is maintained in the office by a card system. Each transformer is indicated by a card showing all the name-plate data, number, location, date installed, removed, and when purchased. Back of this transformer card is an address card, giving the address of the consumer, dates connected and disconnected, meter number, its installation and approximate demand; each installation having an individual card. The approximate demands are added to determine the load on the transformer. This arrangement prevents overloading of transformers and gives the engineer a comprehensive idea of what is going on over his circuits.

A complete pole-line record can hardly be maintained with any degree of satisfaction, and the writer does not believe that such a record is necessary. Any proposed change in a line or improvement in construction cannot be done except by direct inspection of the premises. However, when poles are numbered and a record kept in the office of the date of installation, with the kind of preservative used, some information can be gained regarding the life of a pole.

It is the usual practice in outlying districts to run long secondaries, using as few transformers as possible. This is certainly an efficient arrangement, provided the secondary line is constructed so as to be used for primary current at a later date. The top arm should not be less than a four-pin, the secondary wires

occupying the pole pins, and as the load increases the secondary can become a primary extension and a new secondary line run on an additional cross-arm. This leaves two pins vacant on the top arm for an arc circuit. Under no circumstances should the primary and secondary lines be on the same cross-arm. When three-wire secondaries are run, a four-pin cross-arm is required. In my experience, I have found we have little use for two-pin arms. When lines are run in alleys, it is not advisable to use an arm longer than a four-pin when the arm is placed with its center on the pole, or the arm will extend over into the property line and sooner or later cause trouble by interfering with buildings, and you are also likely to have additional trouble on your hands if the line falls into private property. The system of placing arms off center cannot be recommended, as the pole will invariably lean and lines cannot be drawn taut without twisting the poles.

Lightning arresters should not be placed upon the same pole as the transformer or fuses. All ground wires should be equipped with a convenient device for disconnection at a point about twelve feet above the ground. An ordinary screw connector is suitable for this, and a lineman who fails to disconnect the ground wire before going to the top of the pole is negligent.

Three-wire secondaries in the resident district may save copper at times, but the extra room required and trouble in balancing largely offset the advantages. There are ammeters on the market, equipped with split current transformers, which are very convenient in testing the balancing of three-wire transformers while under operation. This current transformer can be clamped by a lineman over the conductor to be tested, and the amperes are indicated directly to an inspector on the ground. A three-wire transformer may have one side considerably overloaded and the other side very lightly loaded, which might result in a transformer destroying itself even when the capacity of the transformer exceeds the total connected load. If you will take pains to make tests on your three-wire systems, you will find some startling results which cannot be readily accounted for. The ampere readings on the three legs will not always check up, and one side will be carrying considerable more than its share of the load, which will vary with the hour, day, season and year.

If a grounded system is used either in a two or three-wire system, care must be taken that the grounded conductor does not pass through the series coil of the meter. Otherwise a ground on the consumer's wiring will shunt the meter and cause it to run slow. Some companies are using low-voltage lightning arresters on their secondary circuits, which obviates this trouble and several others, but may not afford the same degree of safety from high voltage.

When transformers are connected in parallel, each block should have its individual set of transformers. There is little to be gained by carrying secondary wires across a street in order to make parallel connections. The set of parallel transformers should, when possible, all be connected on one set of fuses, and this set of fuses should not be on the same pole as lightning arresters or transformers. The single set of fuses permits one man to fuse up while the transformers have a full connected load, otherwise a man is required to each set of fuses, and all must put fuses in by a predetermined signal, which can only be done with a certain degree of success. While transformers may operate perfectly in parallel and deliver better voltage, the writer believes that for the ordinary residence district a single transformer, located in the alley near the center of the block, connected to a two-wire secondary system, will give less trouble and can be operated satisfactorily to the consumers. The extra cost of copper is largely offset by the decrease in transformer losses and expense of maintenance.

Each year we see more galvanized hardware on our pole lines. "Cross over" brackets present a better appearance than the buck arm construction for services. Metal clamp-pins are replacing the wooden pins to a certain degree, but are generally considered too expensive for ordinary construction. The clamp-pin quite often prevents a cross-arm from splitting and is particularly adaptable to old arms. They not only give an extra strength to the arm, but are adjustable. Guy shims should be used, as they prevent the guy from cutting a pole and save some slack accumulating. Guy clamps and hub guards on an exposed pole present a substantial and permanent appearance. When a pole is installed in a substantial, workmanlike manner, a property owner may hesitate in asking you to move it.

Distribution systems in the business district present a different condition from those in the residence districts. The lines in the business districts are liable to be old, and we are hampered by other companies' lines. We have but few choices of locations for poles and our lines should be a considerable distance from buildings and fire-escapes. We must also be prepared to furnish several different kinds of current at any point in the block. The poorest line construction can generally be found in the business districts, for the reason that no general plan has been followed.

One company has adopted a system for alley-pole construction in the business districts which the writer wishes to describe. In this instance several residence lighting circuits had to be carried on the same pole-line through the alley, so that a bridge construction work was adopted.

The company's bus bars for distributing service carries 2300 volt, three-phase, three-wire, 60 cycle current, and each of the distribution circuits left the plant three-phase with individual panels and automatic oil circuit breakers. The principal feeders were equipped with three-phase motor control regulators.

In this case the alley was twenty feet wide and the poles were placed with their centers seventeen feet apart. The arc circuits were all placed on the top arm, as they would to a certain extent act as a screen protection to the other circuits from falling lines.

The second arm was devoted to the 2200 volt, three-phase lighting circuits, and the third arm to 500 volt direct current power circuits, police alley lamps, and the secondary distribution which requires six pins.

Each block is considered as a unit; that is, the transformers in adjoining blocks are not connected in parallel and each block has at least three single-phase transformers, ratio of 2200 to 220-110, connected

three-phase delta on the lighting circuit. Each set of three transformers has its own sub-circuit—the sub-circuit having three fuses of its own for the block, all located on one fixture at the end of the block. There are no individual transformer fuses.

The drawing of the fixture indicates that the transformers are supplied from circuit four by means of the sub-transformer circuit T4 on the top arm.

The electrical connections are shown in the wiring diagram. Thus it will be seen that,

110 volt, single-phase, can be furnished from any adjacent pair, including A and F.

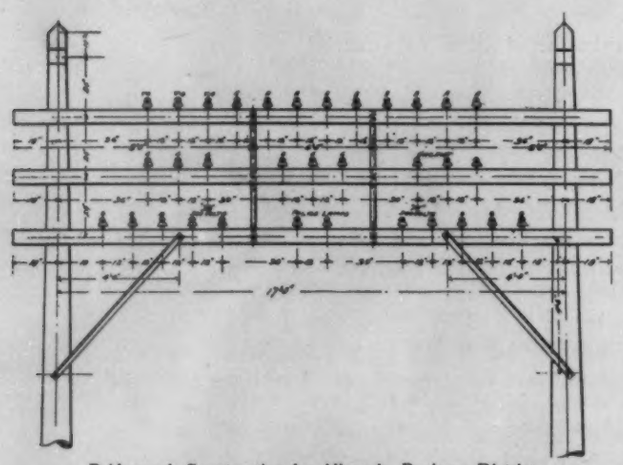
220 volt, single-phase, can be furnished from AC, CE or EA.

110-220 volt, three-wire, from ABC, CDE or EFA.

110 volt, three-phase, from BCD, DEF, FAB or BDF, preferably the latter.

220 volt, three-phase, from ACE.

Thus the company is able to furnish any of the current mentioned for single or three-phase motors, either 110 volt or 220 volt, or single-phase 220 volt for rectifiers, and 110 volt or 110-220 volt current for lighting, all off the same transformers in any part



Bridgework Construction for Alleys in Business District

of the block without going to the expense of additional line construction work. In one instance three 25 kw. transformers were used for lighting, and a 50 horse-power, three-phase motor was connected to the same transformers. As the motor did not run during the main lighting hours, no ill effects were noticed except when starting or stopping the motor, when a slight variation in voltage could be noticed.

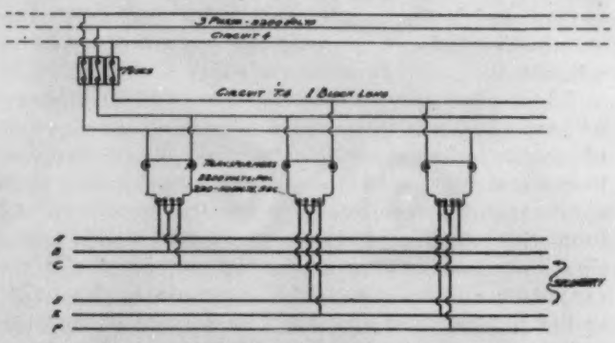
The principal objection to this plan of connecting is the six secondary wires required, but any other system giving the same number of combinations of voltages would require even more secondary wires. The system amounts to a double three-wire system, so that the conductors are not necessarily so large as would be required in a single three-wire system. The transformers are placed in the alley so as to divide the block in approximately three equal parts and each transformer supplies the single-phase current to the nearest territory, which allows little drop in line secondary.

The fuses are readily accessible and the whole block is fused at one time, thus avoiding the difficulty of fusing paralleled transformers with individual fuses when under heavy load.

For protecting the secondary from high potential any one leg could be grounded but the writer prefers to use six low-voltage lightning arresters.

This system of connecting has been in use for some time and has proven very satisfactory. It is certainly a great relief to be able to furnish a consumer with any of the selected standard voltages without constructing some makeshift arrangement for each individual case. In addition, it reduces the transformer core losses to a minimum and reduces the construction cost by using fewer transformers.

Several of the poles are occupied jointly by two or more companies. The street car company's feeders occupy a position on the top gain on one side of the alley, while the opposite side was given to the city's fire-alarm system. It is better for the fire-alarm system to be below the lighting conductors, but due to local conditions this was found impractical. The arrangement of the circuits is such that the secondary lines are three feet from the building line and the light



Wiring Diagram and Transformer Connections for Light and Power Circuits in Business District.

potential circuits are at least four feet, six inches, from the building line, so that any one leaning from a window would not be likely to come in contact with any high voltage current except at points where the transformers are suspended. The services are taken from a six-pin arm mounted on the pole at right angles to the bridge arms.

Distributing circuits covering a large area present greater difficulties in finding trouble, but the plant equipment and necessary room in the plant is considerably reduced. In one case fifteen single-phase lighting circuits, requiring thirty-three feet of switchboard, was replaced with six three-phase circuits requiring five feet of switchboard. The number of conductors leaving the plant was reduced from thirty to eighteen with a corresponding reduction of cross-arms, pins and insulators.

The resident three-phase, 2200 volt circuits are only carried three-phase through the main alley a short distance. All branch circuits are taken off single-phase so as to keep the main three-phase circuit practically balanced.

In order to more quickly locate a short circuit, the main branches have been equipped with pole-line oil switches, so that the branch may be readily cut out for testing purposes.

GENERAL POLICY REGARDING PIPE EXTENSIONS.[1]

BY C. A. LUCKENBACH.

At the sixteenth annual meeting, the secretary of this association presented a notable paper on "Corporation Regulation," in which, after describing the attitude of the public press with reference to public service corporations, he makes use of the following language: "For all this pilloried condition the present corporations and their predecessors in interest have themselves so largely to blame, that a new method of treating the public must be created to restore them to the favor in which they were once held."

In studying this paper and looking into the department in which I am particularly interested for "the original sins," which our secretary calls "in many instances equivalent to the action of get-rich-quick concerns," I am involuntarily drawn to a consideration of the policy regarding pipe extensions and the effect it has on the public pulse and the capital of "good will" of the corporation.

The use of gas in the household is no longer a luxury, in fact it has long since ceased to be so. Even the courts of California have recognized the use of gas as such a necessity as comes within that provision of our civil code, which makes the salary of a wage earner attachable for its use. So generally recognized is this necessity that the home builder has long since reached the point where he is unwilling to enter upon the improvement of property, until he knows to an absolute certainty that when he accepts the keys to a finished building, that building is reached with the pipes necessary to furnish those who occupy it with gas for any purpose desired. In a word, the person who is willing to live in a house which is not supplied with gas is the rare exception. And has he not the almost undeniable right under reasonable conditions, of demanding the same?

When the framers of our state constitution inserted that provision which gives an individual, or a company, the right to enter upon the streets of any incorporated city or town for the purpose of supplying the inhabitants thereof with gas, without specific franchise, but "under the direction of the superintendent of streets, or other officer in control thereof, and under such general regulations as the municipality may prescribe for damages and indemnity for damages," they did so not for the purpose of relieving the individual or corporation accepting its provisions of any burdens, but with a different object in view. It was sought to remove the possibility of oppressive monopoly in handling this and other necessities of life, and in accepting it the individual, or corporation, acquires not only its privileges and its benefits, but its obligations as well. That its object was reciprocal is clearly evidenced by the fact that it retained within the power of the municipality, within which this right or privilege was to be enjoyed, the right to establish and fix the rates to be charged for the service rendered. Whether this provision is a wise one, for either the best interests of the company, or the consumers, owing to the political influences which surround our various municipal authorities, is questionable, but it is still a fact that the provision is in force, and in its enforcement the voter, whether he be consumer or not, has an influence and a power. And this influence and this power he will continue to use as a leverage for securing those rights which he believes he should possess and which he is not able to freely obtain. One of these rights is the ability to secure liberal extension of mains and installation of services upon the application of would-be consumers. And should he not be able to do so, both for the best interest of the consumer and the company? Perhaps the difference of opinion arises from the viewpoint of liberality, which we all know is vastly influenced by whether we are the giver or the receiver. But there must be, and is, a common ground upon which both the company and the consumer can stand in their definition of liberality as applied to these extensions. It is not a difficult matter for a manager to determine the cost of a proposed gas extension, to estimate the probable consumption along the line of such extension, and to decide whether or not it will be a paying one from the date of its installation, and upon such decision approve or reject its construction. Such might, and would be, the cold-blooded proposition from the standpoint of obtaining "all the traffic will bear," but is it the broad and wide policy necessary for the upbuilding of a strong, vigorous and healthy business upon which the investor can depend for good or even fair returns for a period of years? Or is it such a policy as will earn or entitle the company to expect the good will of the general public? In a fixed or settled community, where newspapers are published once a week, where the fact that John Jones has put a back porch on his house is a news item, and where the building of a new house is an event, and not an everyday occurrence, such it might be. But we are dealing with conditions as we find them on the Pacific Coast, where, even before the fires of a terrible calamity had been extinguished, the pluck, energy, courage and grit of the inhabitants had caused them to begin clearing away the debris and to commence the erection of a new city, more elaborate in conception and accomplishment, more beautiful in its architecture, and more secure in its construction, than that which the elements in a few short hours had swept away. We are dealing with conditions as we find them in communities where the orange groves or open fields of to-day are the settled residence sections and well-built-up communities of to-morrow, and such conditions exist in practically every portion of that territory covered by the membership of this association. Why should the pioneers of coming communities be compelled to ask in vain for the use of such necessities until the territory becomes highly remunerative, except it be upon the principle of obtaining "all the traffic will bear"? The acceptance of the privilege to enter upon the streets of the thickly-populated portions of a city carries with it the obligation to extend the service, under reasonable conditions, to less thickly-settled but rapidly and steadily growing sections as well, and no surer means of securing the good will and co-operation of the desirable public exists for the public utility corporation than by adopting this policy. In some cases such a policy may work a hardship for the time being, but in almost every case the result will justify the means and eventuate in added benefits to the company.

[1]Paper read at eighteenth annual convention Pacific Coast Gas Association, Los Angeles, September, 1910.

It can hardly be questioned that the future security and stability of the capital invested in public utility companies depends to a large extent upon the good will of the public. That the public is fickle is not to be denied. Nor can it be denied that this fickleness operates in almost every case against the utility corporation and not for it. It is a condition which the corporation manager knows to exist, which he must expect to meet and which he must be prepared by wise policies to combat and overcome. What surer method is there of reaching the general public, of bringing a gas company to its favorable consideration and of securing a hold upon the people, than by such liberal extensions of mains and installation of services? The writer believes there is none. As to the building upon that foundation, after it has once been laid, is a matter which is not within the province of this paper. There is, however, an element of this discussion which is of vast importance to the utility corporations, and one with which some companies will be compelled to reckon at a future day, and which, in the writer's opinion, is bound to cost more than is ever obtained. I refer to the matter of demanding or accepting bonuses for extensions of mains or installation of services. No public utility corporation should permit itself to be placed in the position of either accepting charity, or of demanding public contributions, toward the building of its plant, or distributing system. An applicant for the service which we sell is either entitled to such service free, or he is not entitled to it at all. If he is entitled to it, he should have it without the exaction of one penny of bonus, or other consideration. On the other hand, if under such a liberal and generous policy as has hereinbefore been referred to, he is not entitled to the entension, he should not be able to obtain it by a thinly-veiled species of bribery.

The incorporators and officers of a gas company know full well that money, and lots of it, is necessary for the building of a works and distributing system to supply the community which it desires to enter, and it should be prepared to meet the demands which it has undertaken to supply and meet these demands upon such a basis as will permit the company to retain the respect of the public. The only basis upon which the collection of these contributions can stand, is that might makes right. The commodity which we sell—gas—is the property of the company until it leaves the meter, and all changes are based, or should be based, upon a fair return upon the investment in a system extending to the outlet of the meter. Upon what basis then can the cost of building the lines to the meter be charged to the consumer? And in this State, where rates are fixed by the municipal authorities, does it not come dangerously near a violation of law, or at least evidence such a contempt for not only the evident intent and purpose of the law, but the right of the consumer, as will eventually cause an uprising which will do a thousand-fold more damage than could possibly be offset by the aggregate amount of the bonuses collected. The time has gone by when the corporation, oblivious to common sentiment and unmindful of public opinion, can force an objectionable and unjust policy upon the people. The bonus-built company will contend that where such contributions are obtained, they are made by tract owners to advance the value of their lots and the salability of their property, and that they are willingly made. It is true that added value is given to the real estate by the laying of gas mains, and it may be true that the real estate owner is seemingly willing, and often offers, to pay for the added value, but is it not equally true that the extension has added no more value to the property of Mr. A., who pays a bonus, than it has to the value of the property of Mr. B., who has made no contribution to the fund for the building of the system? And is it not equally true that the seemingly willing contributor to the extension of the system is willing because he must be? But is he a willing contributor when he casts his vote in favor of a low and often unjust rate, or is he influenced in his vote by his desire to even the score with the company for making him pay for what his neighbor has obtained free?

On what basis of effective argument, with what evidence of injured rights, can the company which has built its system, or any material part of its system, on bonuses, go before the public declaring that a given rate does not afford an ample return on the investment made? Is the company which accepts bonuses, gratuities and charities, able to go before the court of public opinion, or the court of equity and justice, with "clean hands," and show that any rate is too low to afford fair returns on capital invested? Can the bonus-built company, with justice to itself, ask the consumer to build its system, and then pay a rate based upon a return upon the capital which the consumer himself has donated? It appears to me that the time for such policies has gone by, and the manager who adopts such a policy stores up trouble, which, with the present temper of the voting public, is bound to react to the ultimate injury, not only of the company which he represents, but of all other companies engaged in similar business, as well. Truly this is one of the sins which have been called "equivalent to the action of the get-rich-quick concerns."

The defense that bonuses are paid willingly is too often a subterfuge, too often an attempt to conceal a determination not to extend mains unless a bonus is paid; in other and plainer words, a determination to build a system by public contributions and no other. Too often the company accepting bonuses permits would-be consumers right at the doors of its system to go without this necessity until a bonus is paid, and often when such action is in direct violation of law. What defense of any kind, except that which is expressed in the words "the public be damned," can a company, operating within California, make, when it charges a bonus for an extension to supply a would-be consumer within one hundred feet of its main. None, except that it takes advantage of the lack of legal knowledge upon the part of the average inhabitant. And yet it is done, and this violator of the law appeals to the majesty of the law and asks the assistance of the same law it has violated in effect to protect it in its rights. Will it do so? Can he reasonably expect it to do so? What security can you, or I, honestly expect from the enforcement of the law which we treat with contempt? An eye for an eye,

a tooth for a tooth, is the dictum of the old Mosaic law, and it is the law of the present day business world. When we apply it to others, why should we not expect it to be applied to ourselves? It may be true that "good will cannot be created in favor of the corporations by the corporations' good deeds, because such deeds are misunderstood and misconstrued," but that is no reason why the corporation should wilfully carry on a policy which it knows is unjust and oppressive, and which is bound to neutralize the effect of any good deeds which are performed in its name. The time will never come when all of the public will treat corporations justly, nor will the time ever come when all the corporations will treat the public justly, but the time has come, when both the corporations and the public must assist in finding a common ground upon which each can stand with confidence in the other. Corporations are just as necessary to the public welfare as the public patronage is to the corporations, and by urging the adoption of acceptable policies and the eradication of unwise and objectionable policies, each of us can do his share toward securing this highly desirable result.

TELEPHONIC DEVELOPMENT OF COLOMBIA

The Republic of Colombia has an area of 486,000 square miles and a population of over 4,000,000, but its telephonic development in number of telephones and quantity of material is less than that of the ordinary city of the United States. No national statistics upon the subject are obtainable, but it is known that with the exception of a very few of the larger cities and of a few mining camps the entire country is without telephone facilities.

This condition is explainable in a measure by the wide use made of the telegraph system, which in Colombia is well developed and has lines reaching to isolated villages and communities. This system was built by the National Government and is under its special protection and supervision, as well as under its censorship. As the minimum rate for telegraph messages is equal to only 2 cents American currency per word for any distance, extensive use is made of the system.

In this consular district there is but one public-service telephone system. It is in the city of Cartagena and is exclusively owned by F. & A. Franco, local merchants, by whom it is operated as Empresa de Telefonos de Cartagena. This system was established in 1899 and is managed as a private enterprise under an exclusive concession for twenty-five years, granted by the National Government.

The company is not associated with any other in this country in business or by wire connection and it does not possess or operate any wires outside of the city and its immediate environs. There was formerly an extension to the village of Turbaco, 12 miles distant from Cartagena, but this extension has been discontinued on account of the limited use made of the wire and the difficulty in maintaining it intact and free from molestation by unauthorized parties. Connection with the telegraph lines of this city for short distance telephone messages has been occasionally with fair success.

The company maintains a central station and separate business office in this city. Its employes, all men, number 5, and consist of 2 central operators, 2 line runners, and a repair man. There are 100 subscribers to the service, all wires running direct to the central station, there being no party wires. No charges for installation are made to the subscribers within the walls, Cartagena being a city of limited area. For subscribers in the extensive suburbs, erected in recent years outside the walls, installation charges are made for the length of wire from the wall to the subscriber and for the labor cost of laying it.

The hours during which the use of the telephone is permitted are 6:30 a. m. to 10 p. m., while the number of calls is unlimited; the total average is 2480 daily, or 905,200 annually.

The monthly charge for service is $3 for ordinary telephone and $5 for long distance. The latter are of better appearance, are equipped with adjustable extension transmitters, and while there are no long distance connections there is greater clearness in messages.

All the material and apparatus, except 6 telephones purchased in 1909 from Germany, are of American make. (Western Electric Company.) They are all older style, necessitating ringing up the central office in addition to removing the receiver from hook. The principal ones in use are of old-fashioned appearance, with short unhinged transmitter; the other types are the long-distance telephone with transmitter at end of a hinged extension arm and a few of the desk type. The 18 miles of wire are of copper. The iron wire formerly used did not last in this climate.

A private system is operated by the Cartagena (Colombia) Railroad Company, with 15 long-distance telephones, without central office or switchboard, connecting the offices of the company with its stations, workshops, and wharf in this city and with the offices of the local aqueduct company, which is under the same general management. An extension wire reaches to Kilometer 15, 9 miles distant. These are also Western Electric telephones of the older type, but give satisfactory service. The 13 miles of wire are of galvanized iron No. 10.

There are telephone systems in Bogota, with connections reaching its suburbs in Medellin, in Bucaramanga, in Barranquilla, and in Santa Marta. A few private series of telephones without central switchboard are installed in certain large mining camps and haciendas.

It is probable that well-directed efforts to place telephone systems would pay, but the development would not be rapid and the first orders received would be moderate in quantity. To secure this business the energetic work of a competent traveling representative, who could visit the different communities and personally urge the many advantages of telephone facilities, would be required. It is hardly considered probable that more than a few of the cities now unequipped could be persuaded, even by such a representative, to install complete systems, but there would be a fair market for single or party lines without central stations, some of which would form a nucleus for more complete systems in the future.

REPORT OF COMMITTEE ON GROUNDED SECONDARIES.[1]

At the last meeting of the Association held in Denver, Colorado, your committee was appointed to gather as much data and information relative to the grounding of secondary circuits and the results of doing same as was possible, for the purpose of assisting in formulating any necessary rules for the protection of life and property on circuits carrying electric current for lighting and power. A relatively small amount of information was obtained, but your committee believes that a more aggressive campaign taken by your association would result in a more intelligent and closer study being made by the Member Companies on the subject, which would result in a more uniform system of power and light distribution and protection of same against life and property.

A circular was forwarded to each of the Member Companies containing the following thirteen questions:

(1) Name of company.

(2) Do you ground your secondary alternating current systems?

(3) Up to what voltage between ground and line?

(4) On polyphase circuits, at what point do you make your ground connection?

(5) How do you make a ground connection?

(6) Please give record of tests you have made as to resistance and permanency of ground connection.

(7) Please give full history of fatalities and serious shocks occurring on your secondary circuits, and full details as to voltage and conditions under which shock was received.

(8) Please give same data in regard to fires which have occurred on your secondary circuits.

(9) Since your secondaries have been grounded, have you experienced any increase in transformer breakdowns, or any other increased cost of maintenance?

(10) Since your secondaries have been grounded have you noticed any increase in the number of fires due to electric current in the customer's premises?

(11) As a result of experience, do you consider the constant menace of a possible shock of 250 or 300 volts on grounded circuits to be greater or less than the menace due to the breakdown of transformer or crosses between secondaries and high potential lines?

(12) Please give your opinion of the limiting voltage which the rule should specify "must be grounded."

(13) If the secondary of your system is **not** grounded, please give your reasons for **not** doing so.

Replies were received from 17 companies—replies to each of the questions being as follows:

One company only grounds everything up to 460 volts. Another company grounds single phase circuits only up to and including 250 volts. Another company has grounded part of their system for experimental purposes, in order to study the relative protection afforded. The remaining companies report that they have not as yet grounded any of their secondary circuits.

One company reports grounding of their polyphase circuits up to 460 volts, the ground connection being made in the center of the secondary circuit in one transformer on closed delta connection. Another company reports the grounding of their three-phase 440-volt secondaries through spark gaps. Several other companies are considering the grounding of polyphase circuits at the neutral of star connected transformers and open delta connected transformers.

Of the companies using grounded connections, the methods of grounding used by one company is by imbedding a tin copper disc or close spiral made up of No. 4 B. & S. wire tinned, below water level in a bed of ground coke and where water level cannot be reached, in permanent damp earth. Wherever possible the grounds are placed by this company near a stream.

Another company reports that wherever possible ground connections are made to water pipes, but where this is impractical or impossible, ground plates are imbedded in coke dust.

The rules of another company for ground connections are as follows:

The secondary ground connections should be made to a thoroughly grounded water pipe system, or to a first class ground plate installation, or if that is not available, three pipes not less than 1 inch in diameter may be driven into the ground not closer than 10 feet apart, each pipe not less than 5 feet long. The ground wire should be connected to each pipe independently.

The practice of another company is to use iron pipe where same can be driven into the ground; where this is impractical an excavation is made and coils of wire buried.

No reports were received on any ground resistance tests being made by the companies using grounds, but for the information of the Association the committee wishes to state that during the summer of 1907, Prof. E. E. F. Creighton, lightning arrester expert for the General Electric Company made a series of tests on different types of ground connections at the Silverton substation of the San Juan Water & Power Company at Silverton, Colorado. The resllts of the test may be found in the proceedings of the American Institute of Electrical Engineers, Vol. XXVII, Part I, entitled "Measurements of Lightning, Aluminum Lightning Arresters, Earth Resistances, Cement Resistances and Kindred Tests."

The tests in a general way consist of the following:

1. Variation of resistance with depth (dry earth) using iron rod driven in the ground.

2. Variation of resistance with time after salting.

3. Measurement of resistance between pipe in variable multiple groups.

4. Measurement of resistance between different points on the system to determine ground resistance.

From the results of these tests and subsequent observations, it is clearly shown that earth connections are more or less unreliable unless extreme care is used in selecting thoroughly moist earth where pipes or buried copper plates or discs are used, and to in-

[1]Read before the Colorado Electric Light, Power and Railway Association, at its eighth annual convention, held at Glenwood Springs, Colo., September 21, 22, 23, 1910.

sure good ground connection provision should be made for keeping these grounds thoroughly grounded by the application of a brine solution.

A ground connection to water pipe system appears to be the most desirable, but with a large number of the Member Companies it is quite probable that such a favorable condition does not exist, so that grounds of other types must be provided.

One company reports the occurrence of a fatal accident caused by contact between the primary and the secondary circuit of a distributing system, the primary voltage being 2300. Another case was reported by the same company of a consumer receiving a severe shock from a 220 volt circuit due to a defective socket. They report that the test made in this case did not show any contact with the primary circuit, but that the effect of the 220 volt shock was sufficient to render the party unconscious. In none of the above cases were the secondaries grounded.

Another company reports a serious accident to an employe of a power customer who placed his hand upon a 440 volt, three-phase induction motor. The cause of the accident was investigated very thoroughly, and it was found that a discharge of lightning broke down the insulation between the primary and the secondary leads through the transformer case; the primary potential being 17,000 volts and the secondary being 460 volts. The secondary circuit in this case, was not grounded and neither was the frame of the motor. The current from the primary circuit in this case continued to arc over after the discharge of lightning, and was in this condition when an employe of the power user placed his hand upon the motor. The man's right arm and left leg were so badly burned that amputation was necessary. The transformer cases in this installation were grounded by placing same upon the earth in the transformer station, but neither the secondary circuit nor the motor frame was grounded.

The ground connections of the transformer cases, however, were so poor that there was sufficient potential between the motor frame and the ground to cause the severe burning mentioned above.

Another company reports severe shock received from breaking down of transformer insulation between the primary and the secondary, which they claim has been eliminated by grounding of secondaries. The primary potential in this case being 13,000 volts and the secondary being 115 volts. Only one company of those reporting attribute the starting of fires to contact of the primary with the secondary or ungrounded secondaries. This particular case was caused by a severe storm tangling up the primary and the secondary on a 2300 volt distributing circuit. They further report numerous other instances where fires were started by the primary circuit becoming crossed with the secondary.

No additional trouble or transformer breakdowns have been noticed by the companies grounding their secondaries. One company reports that damage to transformers has been decreased. Another company reports that since grounding their secondaries that lightning will sometimes jump from the primary wires outside the transformer to the case and from the case to the secondary and thence to the ground. They state that in some cases, the arc will hold until the fuse blows, and in another case the arc will hold for a few seconds and break without blowing the fuse, and in no case have they noticed any damage done to the transformer.

None of the companies report any increase in the number of fires since grounding of secondaries.

Very few answers were received to the question as to the greater or less menace of possible shock due to the grounding of secondaries. One company states that on mill and power work the constant menace of shock due to grounding secondaries insures better installation and is emphatically less than the danger to life and property on ungrounded circuits liable to transformer breakdowns, crossing between secondaries and high potential lines, and the possible continued existence of unknown grounds putting full circuit potential from the other side of the circuit to ground, instead of only part of the full circuit potential being present intentionally, and provided for.

Another company feels certain that the danger of transformer breakdown and contact between primary and secondary is far greater than the danger of shock in the difference in potential between wires and ground. Another company considers the menace greater. One company states that in their opinion all circuits rated at 500 volts should be required to have some point grounded, giving as much less voltage as possible. Another company reports that the limiting voltage that must be grounded should be 150 volts. Another company reports that lighting secondaries up to 220-250 volts must be grounded. Another company asks why there should be any limit. Another company states that if they were convinced that grounding was best, that they would ground 250 volts. Another company gives 300 volts as the limit that should be grounded.

There seems to exist considerable indecision and varieties of opinion for not grounding secondaries. Several of the companies state that they have talked the matter over but have not as yet decided to ground their secondaries, but expect to do so in the near future.

Other companies give as a reason for not grounding that they have never had any trouble with ungrounded secondaries, and not having experience with grounded secondaries, are not in a position to decide as to the advisability of grounding. Several other companies are not thoroughly convinced that grounded system is the best. One company is uncertain as to the benefits of grounding. Another company states they are using 110 volts on their secondary circuits and consider this, together with a clear line, as the best insurance. Another company is awaiting the results from other companies who are grounding. Another company states that grounding secondaries increases fixed losses by forcing individual circuits for lighting and power, and thereby also increases overhead and transformer investment. Another company states that they have not grounded chiefly because there has been a great difference of opinion regarding the advisability of so doing.

Your committee wishes to make comments on several points brought out in the answers received to questions sent out, among which one is of considerable

importance to power and lighting companies that are operating in the mountainous districts of Colorado, and who are supplying and distributing power over high potential lines where the transformation difference of potential is relatively high, and in which the menace of breakdown is relatively greater than the lower transformation.

In two cases reported, severe shocks and injury was sustained due to breakdown of transformer insulation. In one case on a power transformer from 17,000 to 440 volts and another from 13,000 to 110 volts. In the case of accident on the 17,000 to 440 volts, two conditions were brought out; first the unreliable ground conditions that exist in the mountainous districts of Colorado, and second the menace to life due to the rule of the National Electric Code that motors operating at a potential of 550 volts or less be thoroughly insulated from the ground wherever feasible.

This, your committee believes under the operating conditions existing with a large number of the power companies of this association is a menace to the life of employes operating motors under these conditions, particularly where such motors receive their power from transformers stepping down from a relatively high potential (i. e.) potentials above 5000 volts, and would suggest that this be brought to the attention of the National Board of Fire Underwriters, as in a case of this kind the grounding of secondaries supplying power to an insulated motor would not give absolute protection.

In a large number of cases of shock sustained from the power circuits, the shock is usually received not from the circuit itself, but from the frame of the motor being supplied by the circuit. Where high potential transformers are used for lighting purposes, the neutral point of the secondary circuit together with the transformer case should be thoroughly grounded.

In conclusion, your committee would recommend that the question of grounding be brought more forcibly before the member companies in order that more definite information and a closer study and results be obtained.

The member companies of this association are probably more peculiarly situated as to the importance of the question of grounding than any other association on account of their different operating conditions, location, frequency of lightning storms, transmission and distribution of electric power and lighting over high potential circuits, and unfavorable ground resistances ances that exist in the Rocky Mountain district.
that exist in the Rocky Mountain district.

J. A. Clay, Chairman
C. F. Flower, W. A. Carter, Commitee

Analysis of telephonic speech shows the necessity for clear enunciation. All of the vowels, in compelling an open mouth and throat, give free passage for the vibration of the vocal cords, but most of the consonants, produced either with closed lips or cleaved tongue or being a mere exhalation of breath, do not actuate the vocal cords. The letters f, h, p, q, r, s and t have no distinct sound until a following vowel is sounded, being purely breath; b, c, d, k and w have practically no sound; g and j have a throaty sound, while m and n are nasal. The difficulty in distinguishing between f and s, m and n, etc., is well known.

DISCUSSION ON STEAM ENGINEERING PRACTICE.[1]

Control of Fluctuating Load.

Question: How is it possible to determine the average load on a compound or triple expansion engine where the load is very rapidly fluctuating, i. e., where this fluctuation is not only seasonal but daily, and where you find the fluctuation so rapid as to be almost intermittent as in a plant running a system that is feeding a mine hoist?

In electrical work we are meeting this condition by two methods; by running a motor-generator set consisting of a slip-ring motor driving two direct current generators on the same shaft with a heavy fly wheel; at the mine shaft direct current motors are used. In Nevada a great deal of trouble is caused by the extreme fluctuations and these have been corrected by using storage batteries which result in a continuous and uniform supply of current from the power line. I want to get some information on steam plants where the load is extremely variable.

What would you do in case you were called upon to report the load on your plant if it is seasonal and daily changing as well as intermittently fluctuating?

Answers: There is a plant near Cleveland where a power company contracted to furnish power for coal discharging. When they began to get the coal over the fluctuation was found to be too great and they put in a balancing set; a large motor with a heavy fly wheel, and with this apparatus they took a series of calculations and based their average load upon these. They connected in such a way as to strengthen the motor at the peaks and received very satisfactory results.

I would think that the machine steam meter and the indicator together taken fast enough would give a fair average value. Take for instance the street car system. A recording steam meter would be absolutely correct. I have seen one in the Monadnock Building.

The California street cable road engine allows the pressure to fall during load fluctuations. Once it fell ten pounds within a minute. The variations are so great that at times the engine is run by cars on the system. The steam meter is the only correct way to read that. With a triple expansion engine, while one meter will do, with three meters you can get almost correct results. We have tried the indicator but without avail. Once we tried to get an average of the speed and pressure and struck a pretty fair average. When the cars are running the engine you have two receivers bucking their strength against the cylinder until the steam is exhausted. The cards will show all of this.

While you get the correct steam drawn from the boiler at any instant with the steam meter is that any guarantee that you would get any correct measurement of the power being applied at the same time?

The receivers on this engine are very long, one being about twenty-seven feet. They are so long that when the engine is running along and is gradually shut off the steam is drawn from the receivers. When the load comes on again the power is at first being applied only on the high pressure cylinder. The vibration at this time is terrific. This is due to the fact that when the cars were running away with the engine the steam was drawn out of the engine and receivers and when the load returned the high pressure got all the work. In such a case the amount of the steam would be recorded by the steam meter and we could not get the correct reading otherwise.

I have heard of the chronograph to get the record of the different number of revolutions taking place in any minute. This had a pendulum making a pen mark in the paper and also had a pin to trace every revolution. When the engine slowed down the marks of the pen were all uniform but the pin punctures were further apart.

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[1]California No. 3, N. A. S. E.

Some types of engines have each cylinder arranged with a separate governor. By coupling up three indicators, each one taking the average at the same time, you will get a very close result. I was out to the California street cable engine one day and was stationed at one cylinder, with two other men at the others. We had no electrical apparatus. We took off a pretty fair average this way and I think we were right. When the governors were clear up we would take a look at our different cards at those times, and we could arrive at a pretty close record of what the engine was doing under all conditions. The load on that engine runs from six hundred horsepower down to nothing. I think they run thirty-five or forty cars. In the Alaska Commercial Building they were using a tandem compound engine running the Otis traction type of elevator. The current required for that type of elevator in starting is much more than when started. At times the engine was pulling all that it could and the very next moment, as indicated by the ammeters, the load was gone entirely. A short time ago they installed a storage battery with a balancing set. The load is now almost constant on the engine with practically no change. When the elevators are stopped the engine goes right along and pumps back into the batteries. That is how they get along with the intermittent load. The ammeter varies from 600 up to 1000 and back to nothing.

This question may be answered in many ways, as the installation of steam driven light and power equipment differ radically in nearly every station under observation. The experience of the writer as an operating engineer lies chiefly with alternating current dynamos of from 2300 to 4000 volts, as regards the subject of speed regulation, with various forms of power transmission from the several types of engines.

As an illustration of how two machines may be operated harmoniously with fluctuating loads of an entirely different character, we will take for example, two 500 kw. 2300 v. alternating current dynamos. Machine No. 1 is working to full capacity in street car service (via motor generator sets) and is driven by a tandem compound Corliss engine running at 75 r.p.m. and controlled by an ordinary fly-ball governor. The transmission of power from engine to dynamo in this case is through a seven rope drive, the total length of rope in use being 2500 lineal feet.

Machine No. 2 is directly connected to the shaft of a cross compound engine having cranks at 180 degrees and is regulated by a shaft governor set to 150 r.p.m. This engine is run upon lighting circuits exclusively and loaded to a 30 per cent overload.

Now as the operating engineer finds his lighting load reaching the peak on machine No. 2 he is also aware of the drop in frequency from his standard of 60 cycles to, we will say, 58, and at the same time he notes the fluctuations of all recording instruments upon the lighting panel, which represent to him the lagging of his over loaded engine in crossing crank centers. At this point something must be done to retain the normal voltage if possible. He watches his power panel and finds a fluctuation of perhaps four cycles due to the general conditions of a street car system. Here is his hope for the restoration of his lighting circuit voltage, and he is quick to take advantage of it, the synchronizer is put into operation and as the power load on outfit No. 1 increases to the detriment of the speed, it finally drops to that of outfit No. 2 and the machine bus-bars are united as one, giving a harmonious operation throughout the hours of the overload.

The above operations show what may be done in regard to converting the light and power appliances of yesterday and today to a unity. In this case the sluggish action of the Corliss governor plus the loss of quick action of the machine due to stretch and slipping of the 2500 feet of rope kept the speed of machine No. 1 constantly fluctuating.

Machine No. 2 was overloaded and with engine cranks at 180 degrees was unable to retain normal speed passing centers.

The combination of outfits gives better results in many ways. First—When the operator put the machine into a synchronous action he caught one engine crank at an angle to the other which was of benefit to both engines. Second—Machine No. 1 was able to assist in raising the lighting load voltage at each lightening of the power load. Third—With the quick increase of the power load which formerly slowed the engine, the quick action of the lighting engine governor would rescue the falling speed of the slow running Corliss.

Coal.

Coal is an organic compound which has been subject to pressure for a long time. Its chief ingredients are hydrogen, oxygen, nitrogen, carbon, sulphur and ash.

A few of the best known lump coals are Newcastle (England), Scotch (Scotland), Wallsend (Australian), Chin-Wan-Tau (China). There is also a good steam creating coal to be had in Japan called Miki Nuts. It is very small, never more than 1¼ inches square, and seldom smaller than ½-inch square. Welsh coal has little flame and little smoke, being called smokeless. It comes from the outskirts of Cardiff, Wales.

The first named lump coals give much flame and smoke and burn much faster than Welsh coal, but do not give out such an intense heat, locally, as Welsh coal.

Corrosion of coal, a matter to which few engineers give much thought, is an important item where there is a large amount to be kept on hand. Corrosion can be seen if a piece of soft coal is taken up and broken into small pieces until a golden colored spot is seen, this spot being the result of the coal burning before being put into the furnaces.

Some time ago the British government made a test to see if they could remedy this serious matter. They made an oblong tank and put 500 tons of coal into it, this they lowered into the water in one of their docks in Portsmouth, being kept there for a year. At the same time they had 500 tons of the same coal exposed to the elements for the same length of time. Afterwards burning experiments proved that the coal which was under water had a loss of only 5 per cent while the coal which had been exposed had a loss of 25 per cent. They proved that the coal which was exposed to the attack of the air, rain, snow, etc., burned more after rain than it did before, and that the longer it was exposed the greater corrosion became. And again they proved that the coal under water stopped corroding until brought out again.

The space occupied by coal varies from 42 to 45 cubic meet per ton. The fire-bars should be spaced about ⅝ in. for Welsh coal, but the firemen should not knock it about, or it is likely to fall into the ash pits. Newcastle, Scotch, Wallsend and Chin-Wau-Tau coals can be fired economically with the fire-bars spaced at ½-in.

CHARLES MORTON.

Electric lamb forcing is reported by Professor Silas Wentworth of Los Gatos at his experimental farm on the Tyler place, near Roseville, California. It is stated that a band of 2000 sheep was divided, one-half being placed in a field under the power wires of the Great Western Power Company, while the others were kept away from electric influences. In the field under the electric power line the production of lambs averaged a fraction over two lambs to each ewe. In the adjoining field where electrical influence was lacking, the lamb average was less than one to each ewe. Similar differences were noted in the yield of wool from the sheep in the different fields. The fleeces from the sheep in the electric influenced field proved 20 per cent heavier.

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Service Extensions

The latest census returns show that the long advocated "back to the country" movement has at last started. Suburban communities are rapidly gaining in population because of the superior inducements they now afford. Paramount among these attractions are those comforts and conveniences, such as light, heat, power, water and communication, which have heretofore been found only in the cities. One of the strongest arguments of the real estate dealer is that water and gas have been piped to his property, that electric and telephone lines pass through it and that a suburban trolley line is nearby.

To provide these facilities for outlying communities is a serious problem, for the initial investment is large and the subsequent revenue from scattered consumers much less than that from those congested in the narrow confines of a large city. Public service corporations are often severely criticized and lose much popularity because they refuse such extensions free of charge. They are frequently arraigned, as by Mr. C. A. Luckenbach in his paper on "General Policy Regarding Pipe Extension" because they demand a bonus. Mr. Luckenbach's remarks, while written for gas men apply with equal force to those operating electric railroads, telephones, electric power plants and waterworks. His conclusions are founded upon the idea that a public servant must keep the good will of the public it serves.

While this is in a large measure true and should be well heeded by the companies, there is another side to this question which should be brought prominently to the attention of the public. Many a public service company is now compelled to put all its earnings into unprofitable extensions. Though in time these may also produce their share of income, there is an interminate interim during which they are operated at a loss.

We thus have two extremes, one where the extensions are made by the company regardless of future income, and the other where a certain bonus is paid by those desiring the service. These two extremes are illustrated at almost every farm house which has free rural delivery, but which is visited by the butcher only twice a week. R. F. D. on the farmer's envelope is today one of the causes of our postal deficit and yet its money cost is more than compensated by its advantages. The butcher goes only to a profitable territory and charges as he pleases. The farmer that he does not serve must drive his own team to market if he wants meat.

The public service corporation usually adopts the mean of these two extremes and devises some method by which the consumer bears at least a part of the initial investment. No odium attaches to a steamship company because it accepts a government subsidy whereby it is enabled to operate an otherwise unprofitable line. Likewise if the public were educated to see this matter in the same light, the public service corporation would not be stigmatized for requiring a reasonable amount for improvements if they were to be installed at a loss and if the company received no other compensation, such as a valuable franchise.

PERSONALS.

C. L. Cory is at Los Angeles.

A. W. Ballard of Los Angeles was at San Francisco this week.

Frank H. Ray, of New York, was at San Francisco during the past week.

A. M. Hunt returned to San Francisco during the past week from Southern California.

H. B. Woodill, an electrical supply dealer of Los Angeles was at San Francisco this week.

R. J. Russell, secretary of the Century Electric Company of St. Louis, Mo., is at San Francisco.

Henry T. Scott, president of the Pacific Telephone & Telegraph Company, left last week on a trip to New York.

J. W. White, sales engineer with the San Francisco office of the Fort Wayne Electric Works, is at Goldfield, Nev.

Frank Fowden, manager of the Brooks-Follis Electric Corporation, has returned to San Francisco from Los Angeles.

Walter Creasey has resigned as chief electrician for the Copper Queen mine of Bisbee, Arizona, and is now at Los Angeles.

E. G. Dewald, with the Pelton Water Wheel Company, has returned to the San Farncisco office after making a tour of Utah.

H. A. Sayles, of the sales department of the Holabird-Reynolds Company, has returned to San Francisco from a Northern trip.

George C. Holberton, general manager of the San Francisco Gas & Electric Company, has returned from an extensive Eastern trip.

J. H. Hornung, commercial agent of the Great Western Power Company of San Francisco, is spending a vacation in Northern California.

Thomas Mirk, of Hunt, Mirk & Company, has returned to his San Francisco office after inspecting some work in progress at San Diego.

L. H. Baldwin, assistant manager of the Pacific Coast agency of the Kellogg Switchboard & Supply Company of Chicago, is in Southern Oregon.

C. E. Sloan of Spalding, Sloan & Robson is at Madeleine, Lassen county, Cal., where a number of irrigation ditches and a large reservoir are to be constructed.

W. S. Heger, California district manager of the Allis-Chalmers Company, has returned to San Francisco after spending a few days at his Los Angeles office.

H. H. Noble, president of the Northern California Power Company, consolidated, is making an inspection of his hydro-electric system in Tehama and Shasta counties, California.

J. P. Downs, traffic superintendent of the Pacific Telephone & Telegraph Company, has returned to his San Francisco office after an inspection tour of the company's lines in the Pacific Northwest.

L. A. Richards, in charge of the car department, and S. K. Colby, vice president of Pierson, Roeding & Co., are at Atlantic City to attend the annual convention of the National Street Railway Association.

R. W. Gray has been appointed Division Plant Superintendent of the Western Union Telegraph Company's Pacific Division with headquarters at San Francisco. He was formerly in the service of the Pacific Telephone & Telegraph Company at Portland, as Division Plant Engineer.

R. S. Chapman, electrical engineer with H. M. Byllesby & Co., recently returned to the firm's Portland office from Chicago.

R. E. Thompson, general manager of the San Diego Home Telephone Co., is at San Francisco in connection with some important extensions.

Will Spalding, formerly construction engineer with the Portland Railway, Light & Power Co., has been appointed general manager of the Tillamook Electric Light & Fuel Co. at Tillamook, Oregon.

A. G. Wishon, general manager of the San Joaquin Light & Power Company, with headquarters at Fresno, arrived at San Francisco last week and spent several days in conference with prominent electrical men.

J. F. Adams, general manager of the Nevada, California & Oregon Telephone Company with headquarters at Reno, Nev., visited San Francisco during the past week. He is making preparations to install a local plant at Alturas, Cal.

O. Shortall, of the construction department of the Electric Storage Battery Company, of Philadelphia, is spending some weeks on the Pacific Coast, making his headquarters with Pierson, Roeding & Co.

William A. Newcome was recently appointed manager of the San Francisco office of the Western Union Telegraph Company. He is an old resident of the city, having lived here for fifteen years. For several years past, however, he has been in the diplomatic service of the government at Washington, D. C., and abroad. He returned lately from an extensive European tour.

TRADE NOTES.

The Tramway Safety Appliance Co. of San Francisco has equipped one of the cars of the United Railroads Company with its device for preventing platform accidents. It is now under test.

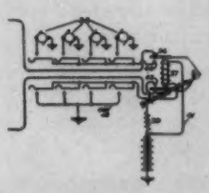
The Pomona Valley Telephone & Telegraph Union has awarded a contract to the Kellogg Switchboard & Supply Co. for a complete multiple, harmonic switchboard, together with auxiliary equipment for use at Lordsburg, California.

The General Electric Company is building for the Long Beach, Cal., steam station of the Southern California Edison Company, a large switchboard to control one 15,000 k.v.a. 11,000 v. turbo-generator, three 2000 kw., 11,000 v. local feeders, two 11,000, 35,000 to 70,000 v., 6000 kw. step-up transformers, two 35,000 v. and two 70,000 v. outgoing lines. The switchboard will consist of instrument and controlling benchboard, vertical exciter and auxiliary panels, together with complete equipment consisting of DH and HE instruments, DS-5 watthour meters, motor operated H-3 and solenoid operated K-12 oil break switches, 11,000 v. graded shunt and 35,000 and 70,000 v. aluminum cell lightning arresters.

The General Electric Company reports the sale of two additional 4000 kw. generators to the San Joaquin Light & Power Company. The generators and auxiliary apparatus, it is understood, will be installed in the North Fork hydro-electric station, about 40 miles from Fresno, where two similar units have been in operation several months. The apparatus sold is rated as follows: Two A. T. B. 18, 4000 kw. 400 r.p.m., 2300 v., water-wheel driven generators. Also, one motor-generator exciter set; M. P. 6, 100 kw., 900 r. p.m., 250 v. shunt-wound generator, direct connected to one I. 8, 150 h.p., 2500 v., induction motor, also arranged for direct connection to a water wheel. Also seven W. C. 60 cycle, 1500 kw., 20,050 v., 169,500 v, y—2300 v, transformers, complete with switchboard equipment. Doble water wheels will be direct connected to the new generators. J. G. White & Co. have charge of installing all of this new apparatus.

PATENTS

971,650. Four-Party-Line Ringing-Key. Alfred H. Weiss, Chicago, Ill., assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. In a telephone system, the combination with a telephone line, of a plurality of substations on said line, each having an annunciator, of a cord circuit adapted to be connected to said line, a plurality of selective ringing contacts associated with said cord circuit each adapted to



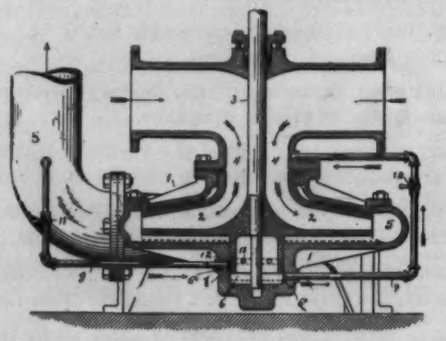
selectively signal one of said line annunciators, a path for voice currents around said contacts, and an electro-magnetic device having its circuit completed through said contacts, said device being adapted to be energized by the actuation of the ringing key to connect said contacts with the talking circuit when any one of said contacts is operated to call a subscriber, the restoration of said device being under the control of said ringing key, substantially as described.

971,649. Inductor-Motor. John E. Webster, Pittsburg, Pa., assignor, by mesne assignments, to Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa. In a dynamo-electric machine, the combination with a core member, and

conducting bars extending through and beyond its ends, of conducting blocks between the projecting ends of the bars, a plurality of convolutions of wire surrounding the blocks and the ends of the bars, and means for securing the ends of the wire to one of the bars.

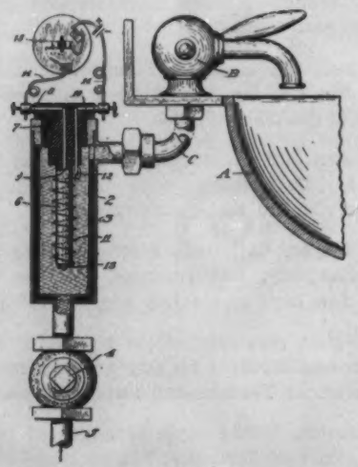
971,767. Thermo-Electric Couple. Albert L. Marsh, Detroit, Mich., assignor to Hoskins Manufacturing Company, Detroit, Mich. In a thermo-electric couple, a positive element formed of an alloy containing a relatively small proportion of aluminum and a metal having the properties of nickel, in such alloy, of obtaining in cooperation with a nickel-chromium negative element, high electromotive force, a high melting point and a comparatively straight line electromotive force-temperature curve, an electro-positive element formed of an alloy containing nickel and approximately 2 per cent of aluminum.

971,852. Centrifugal Pump. Ferdinand W. Krogh, San Francisco, Cal. A self balancing centrifugal pump comprising a casing having a suction inlet and a pressure outlet, a ported pressure chamber, pipes respectively connecting the ports of the chamber with the inlet and outlet, and an impeller wheel arranged within the casing directly above the



chamber and provided with a depending hollow plunger adapted in one position to close the port of the chamber connecting the inlet, said plunger being provided with a passage which is adapted, in another position of the plunger, to communicate directly between the other port of the chamber and the interior of the plunger.

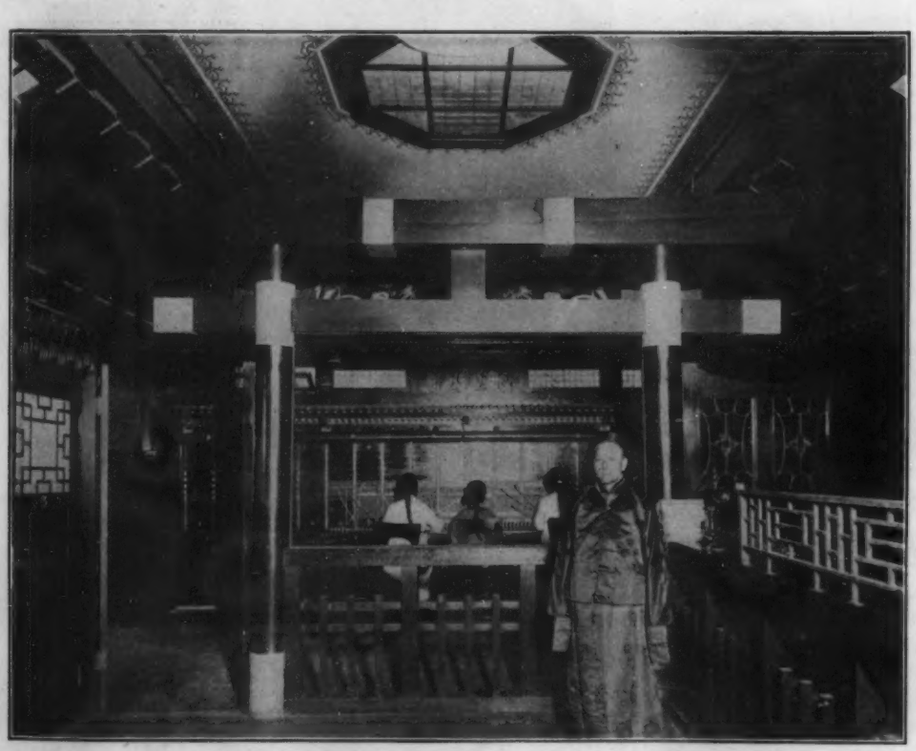
972,131. Electrical Heater. Milton H. Shoenberg and George T. Marsh, San Francisco, Cal., assignors to Appliance and Electric Device Company. The combination with a supply pipe and a controlling cock, of a casing having axially alined openings at opposite ends, a non-conducting lining within the casing, said casing having its upper end internally threaded and having an extension from the lower end adapted to connect with said supply pipe, non-conducting



tube within the casing having an enlarged head externally threaded to engage the internal threads on the casing, said tube having the portion below the head of reduced diameter, and terminating above the lower end of said casing, a resistant conducting coil surrounding the reduced body of the tube, an electrical conductor projecting from the lower end of the tube and connected with one end of the coil, a second conductor passing through the head and connected with the upper end of the coil, and binding posts upon the opposite sides of the head exterior to the casing, with which posts the conductors are connected.

INDUSTRIAL

Exterior of Chinatown Telephone Office



Manager of Chinatown Exchange in his Oriental Costume

SAN FRANCISCO'S UNIQUE TELEPHONE EXCHANGE.

San Francisco's telephone system contains an exchange which is not like any other telephone office to be found anywhere. In its appearance, the personnel of its operating force and the character of the service it gives, the Chinatown "central" is unique. This exchange is further interesting as a part of the telephone facilities of one of the best telephoned cities in the world.

The Chinatown telephone building is strikingly Oriental in its exterior and interior details. The plans were worked out by the telephone company, with the aid of a prominent Chinese merchant. The structure has three pagodas, giving it the appearance of the residence of some important Chinaman, for in China the number of roofs on the house indicates the rank of its occupant. The woodwork in the interior of this building is rough-cut material, finished in ebony.

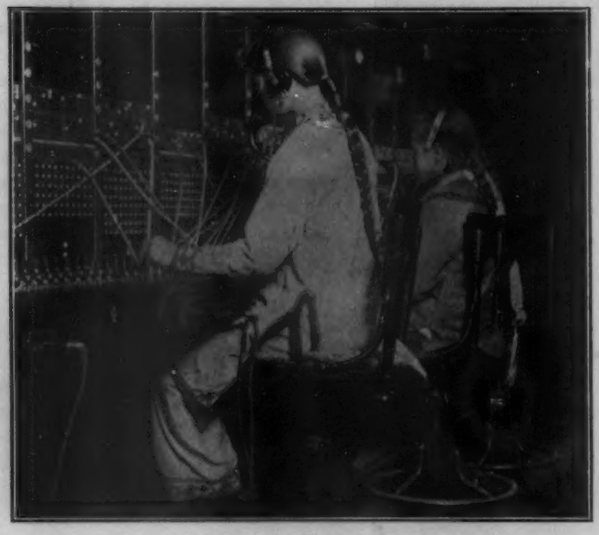
This exchange is one of nine operated by the Pacific Telephone and Telegraph Company in San Francisco and is on Washington street in the heart of Chinatown, a few blocks from the Bush-street central office. With the exception of the sign outside the front door and the fine new multiple switchboard within, everything about this building is truly Chinese. The manager of the exchange is a Chinaman, so is the chief operator, and the switchboard operators are Chinese boys and girls.

The manager, Loo Kum Shu, is an American-born Chinaman, and has been associated with the branch of the Bell Company in San Francisco for about ten years. Mr. Loo has complete charge over the 3500-line board and his little operating staff. The chief operator's name is Ah Sing. Like the manager, Ah Sing speaks good English, and so do the three little girl operators, whose names are Ah Mee, Ah Bow and Ah Soo. The other three operators are Chinese boys. These young people have been recruited from the mission school in Chinatown, and they are said to make excellent operators.

Some little time ago, when Chinese telephone commissioners were in this country investigating telephone plants for their home government, they were shown this Chinatown exchange and were

much impressed by the work of the Chinese operators. It was demonstrated to them that an American switchboard can very conveniently be adapted to the uses of the Chinese, and this is believed to have been one of the reasons why they selected for the first exchange of the new Peking system an equipment from the same shops at Hawthorne.

The switchboard at present in the Chinatown exchange is a comparatively new one, having been installed since the big fire of 1906 in San Francisco, which completely destroyed the telephone building and equipment then in use. It is now taking care of 800 subscribers' lines. The board is a Western Electric Number One, a central battery equipment of the most up-to-date type.



Chinese Girl Operators in San Francisco

This exchange handles only calls for stations in Chinatown. Whenever a call from an outside station destined for other points comes in the operator switches it over to the Bush-street exchange.

The girl operators know the names of nearly all the Chinatown subscribers and are able to switch the calls about without resorting to the directory. As a matter of fact, the Chinese part of the San Francisco telephone directory is not arranged by numbers, but by names of streets, and a caller for a station in Chinatown gives the name of the firm or individual he wishes to reach.

In the basement of the building containing the cable rack and all the other apparatus other than the switchboard, the usual standard construction of the Pacific Telephone and Telegraph Company is carried out. The energy for this exchange is obtained from 11-cells, Type E-11, "Chloride Accumulator," manufactured by the Electric Storage Battery Company. The battery is charged by means of a 30-ampere mercury arc rectifier.

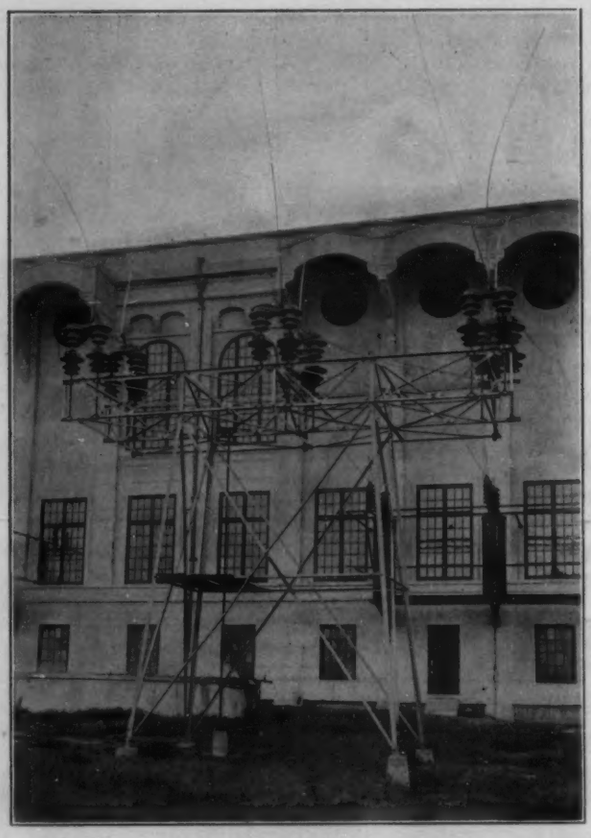
TEST OF 104,000-VOLT KILARC SWITCH.

At the Bay Shore substation of the Sierra and San Francisco Power Company is installed a Kilarc open air switch, built by the Bowie Switch Company, through which passes one of the incoming lines from the Stanislaus Power Company. The system is operated at 104,000 volts—the highest pressure at present in commercial use. This switch was built for operating under load, to handle at least 10,000 kw. It is of special design, but the operating parts for breaking the load are similar in principle to those of the standard type K switch built by the same company. By the direction of motion of the blade, the arc is first drawn upwards, away from the insulators, thereby avoiding any possibility of the heat of the arc affecting the insulators.

This switch, which has been in service for the past three months, is situated in a location particularly severe on insulators, owing to the salt fogs, high winds and dust. Furthermore, the insulators have not been cleaned since it was installed.

To determine the ability of the switch to open under load, a test was recently made by loading the lines with an inductive load of 52 amperes on the high-tension side, or over 9000 kilovolt amperes. The switch handled the load without the slightest difficulty, and opened without causing any voltage disturbance to the system, other than would occur from the change of current. There was practically no surge on the line, and the pressure at the power-house raised only 3500 volts, or about 3 per cent maximum when the switch was opened. This was conclusive demonstration that no material voltage rise accompanies the opening of horn switches of proper design.

This is a subject which has caused considerable discussion



The Bowie Disconnecting Switch

by engineers, as some have maintained that the opening of air switches would set up serious oscillations in the line. Air switches of improper design are liable to cause trouble, but the results of experience have shown that well-designed horn type switches will operate without causing material disturbance of voltage.

This test was particularly severe owing to the highly inductive load which tended strongly to maintain the arc, and to have the stored magnetic energy kick back on the line. Judging from the manner in which the switch operated, its actual capacity is far in excess of the rating. The photograph shows a view of the switch, which is mounted on a structural steel framework, thoroughly braced.

The Kellogg Switchboard & Supply Company of Chicago has closed a contract for a toll-board for the Home Telephone Co. of Spokane, Wash.—the company controlled by the Lane syndicate. It is a nine-position toll-board, complete with desks and testing equipment.

SINGLE-PHASE TRACTION IN FRANCE.

The electrification of existing steam railways is being pursued with activity in France. One of the latest electrifications is that which the Midi Railway of France will make in connection with the Montrejeau-Pau portion of the Toulouse-Bayonne Line. The portion to be electrified has a length of some 70 miles; the country is very hilly and the line has a number of gradients, one of 3½ per cent being about seven miles in length. This is the largest scale upon which electrification of existing lines has been attempted in France, and the results will be watched throughout Europe with no little interest. Later the electrification is to be extended to the entire Toulouse-Bayonne Line, a distance of 200 miles.

The Midi Railway Company has ordered from the French Westinghouse Company, whose works are at Havre, the equipments for 30 double bogie electric motor coaches for the passenger service and one complete electric locomotive for the freight service of this line. The locomotive and motor car equipments will be built entire'y at the Havre works of the French Westinghouse Company, while the mechanical part of the locomotive will be built by the Italian Westinghouse works. The design and construction is based on the results obtained in connection with the very successful electrification by the Italian Westinghouse Company of the Giovi tunnel section of the Italian State Railways on the dense traffic line between Genoa and Milan.

Each of the 30 motor coaches, each seating about 50 passengers, will be equipped with four 125 h.p. Westinghouse single-phase motors, 16 2-3 cycles, 285 volts, and with Westinghouse multiple control. These motor coaches will be able to haul trains weighing 100 metric tons—including the motor itself—at a speed of 45 miles per hour on level track. The weight of a motor coach in running order will be about 56 metric tons.

The Midi locomotive will be provided with five axles, three of which will be driven by the motors through jack shafts and connecting rods. The locomotive will be equipped with two 600 h.p. single-phase motors. The locomotive will weigh 80 metric tons and will be able to haul trains weighing 400 metric tons, inclusive of the locomotive. With a haulage load of 280 metric tons the speed will be 25 miles per hour, and with 100 metric tons about 38 miles per hour.

The current will be supplied to the motors by means of a 12,000 volt overhead catenary line. The pantagraph type of trolley will be used.

NEW KELLOGG CONTRACT.

The Kellogg Switchboard and Supply Co. announces that it has closed a contract for complete switchboard equipment for the Raleigh Tel. Co., Raleigh, N. C. There is to be a new standard type switchboard consisting of two sections, each having a capacity of 3000 multiple jacks. The two sections are equipped with 700 common battery lines installed in five regular positions, with full multiple installed every four panels and twenty magneto lines installed in the first position next to the box panel.

Each of the regular positions is equipped with fifteen common battery cord circuits, each pair of cords having an individual four-party ringing key. The farmer's position is equipped with ten combination toll to toll and toll to local cord circuits.

The Kellogg Company also furnishes the necessary main distributing frame and relay rack. The telephone company will use the present power equipment.

This switchboard has some special patented operating features in it which were furnished at the special request of the manager, Mr. W. A. Wynne. The system is so wired that when any subscriber removes his receiver from the hook, he will be immediately connected with the operator, who will receive the request for the subscriber desired and plug in with the calling cord and ring the desired party before inserting the answering plug, thus giving quicker service. If, however, another call should come in before she completes the first call, the operator can prevent the second calling party from interfering by plugging into the answering jack with the answering cord in the usual manner.

A subscriber often desires to call several parties in rotation and the cord circuits have a special feature for this arrangement that after conversation has been completed all the calling party has to do to again be able to speak directly to the operator is to operate his switch hook once. He will then be able to tell the operator what party he desires next and this without the operator having to throw her listening key.

This arrangement has already been used in this system for several years with great satisfaction to the subscribers.

While the Kellogg Company emphasizes the importance of standard equipment, they are anxious to co-operate with customers in the installing of equipment especially suited to individual needs and offer unequaled experience and factory facilities for the building and installing of special service equipment.

NEW CATALOGUES.

Bulletin No. 9635, describing Hawthorn Commercial and Folding Type Mazdaliers, has been issued by the Western Electric Company.

Bulletin No. 4767, just issued by the General Electric Company, illustrates and describes motors designed particularly for use in steel mills.

Bulletin No. 234 from the Sprague Electric Company illustrates and describes portable electric breast drills designed for either direct or alternating current.

The General Electric Company has recently issued an attractive bulletin, No. 4755, illustrating and describing the electrical equipment of the Great Northern Railway.

Paragon Bulletin No. 1 from the Paragon Sellers Co., 69 Fifth avenue, Chicago, illustrates and describes the Paragon ground cone which is intended as a protector against high potential static discharges.

A new bulletin on the isolated plant direct current combination generator and feeder panels, No. 4763, which supersedes previous bulletins on that subject, has just been issued by the General Electric Company.

Charles C. Moore & Co., San Francisco Pacific Coast mangers for the Babcock & Wilcox Co., are distributing the 1910 catalogues of Sterling Boilers. This 21 page book is attractive'y illustrated in colors and bound in board covers 8x10.

The Western Electric Company has issued booklet T-206, describing its composite telephone and telegraph system for railway service. This system has been devised for the purpose of enabling telephone and telegraph messages to be transmitted simultaneously over grounded telegraph lines.

Bulletin No. 4749 on alternating current switchboard panels has been issued by the General Electric Company, and will prove of interest and great assistance to any one considering purchase of switchboard panels. The panels illustrated in this bulletin are of the sectionalized type, and each section has a separate catalogue number. These panels are in three sections, and the pages of the bulletin are sectionalized so that the user may have before him a picture of the complete panel desired, together with a full description of the equipment.

NEWS NOTES

INCORPORATIONS.

MT. VERNON, WASH.—The Home Water Power Company, capital $50,000, has been incorporated by J. E. Perrin, D. E. Henderson and Thos. Smith.

EL CENTRE, CAL.—The Imperial Valley Electric Company has been incorporated by J. W. Finch and C. F. Ferguson, with a capital stock of $10,000.

ONTARIO, CAL.—The Manzanar Water Company has been incorporated by G. A. Hanson, Isaac Baxter and C. E. Sears with a capital stock of $250,000.

MONTEREY, CAL.—The Mission Home Telephone Company has been incorporated by Thos. J. Field, Arthur G. Metz, E. Cook Smith, Carmel Martin and Geo. S. Gould, Jr.

SAN ANREAS, CAL.—The Patent Electric Fuse Spitter Company has been incorporated by Frank Bernardino, J. B. Sause, T. C. Peters and F. M. Sorracco of Sutter Creek, with a capital stock of $200,000.

STOCKTON, CAL.—Articles of incorporation of the Tidewater and Southern Railroad Company have been filed here. The road is to be electric and the capital stock is placed at $1,000,000. While the exact route of the proposed road has not been made public, it will be built directly from Stockton to Modesto and thence to Turlock, tapping a rich section. At Atlanta, in the southeastern part of the county, a branch line will be constructed to Ripon for a feeder. The board of directors given in the papers filed by Attorney A. L. Levinsky are as follows: John A. Mehling, J. A. Coley, K. C. Brueck, George E. Minges, George F. Schuled, Byron A. Bearce and T. J. Wisecarver.

FINANCIAL.

SEATTLE, WASH.—A $1,400,000 bond issue will be submitted November 8th for the extending and enlarging of the city light plant.

CORNING, CAL.—By a vote of 163 to 23 the bond issue has been voted providing for the raising of $70,000 for a water and sewer system.

SACRAMENTO, CAL.—An ordinance has been passed calling an election for November 17th to vote on bonding this city for $666,000 for a municipal filtration plant.

LOS ANGELES, CAL.—The friendly suits brought by a local taxpayer to test the legality of the $6,500,000 harbor and power bond issues recently voted by the city has been decided in favor of the city.

SAN FRANCISCO, CAL.—The Union Trust Company of San Francisco, as trustee, invites written offers up to 11 a. m. October 22, for the sale to it of the Humboldt Transit Company's first mortgage 5s for redemption to the extent of money now in the sinking fund—$4220.

TRANSMISSION.

VANCOUVER, B. C.—C. H. Cahan, president of the Western Canada Power Company, owners of the Stave Lake plant, states that by January 1st the plant will be able to supply 30,000 horsepower.

REDDING, CAL.—Work is progressing rapidly upon the Coleman plant of the Northern California Power Company, on Battle Creek, 12 miles from the Sacramento river. The steel frame and much of the machinery is on the ground. This plant is being constructed in accordance with the designs by Rudolph W. Van Norden of San Francisco who is acting as consulting engineer for the company.

GEORGETOWN, CAL.—The Rubicon Water & Power Company has a large force of men in the field rushing the preliminary work for its large electric power plant on the American River above Georgetown.

GLENWOOD SPRINGS, COLO.—The Glenwood Light & Power Company are adding a 200 kw. General Electric water driven generator to their plant. It is hoped that with this addition they will be able to use the steam unit merely as a reserve.

SANTA FE, N. M.—An application has been made by Homer W. Schofield of Alamagordo, N.M., for waters of Tularosa creek in Otero county, to be diverted through the Tecolote ditch to a reservoir for power and irrigation purposes at a cost of $15,000.

OROVILLE, CAL.—With the settlement of the suit brought by the Great Western Power Company against the various Maack estates in this county, the power company has practically completed its rights of way for its second tower line of high tension wires from this city to Oakland. The company has been quietly engaged for the past year in buying rights of way for its double tower line.

PUEBLO, COLO.—The Pueblo Traction Light & Power Company are adding new equipment to their steam power plant, including two 1000 h.p. Sterling boilers, with patent stoking devices, and one condenser, one 1500 kw. Allis-Chalmers horizontal type turbine. The boilers are already installed and they expect to have the condenser and turbine installed in about six months. The company are making their own installations.

LAKEVIEW, ORE.—The Southern Oregon Water Power Company has made final arrangements to install a plant on Deep Creek, three miles from Adel, to generate 10,000 horsepower to be transmitted to Goose Lake, Chewaucan, Warner and Catlow valleys, and to be used for power and light in Lakeview and other towns. Engineer Charles McIntyre of Spokane will begin actual construction not later than June 1, 1911.

GEORGETOWN, CAL.—The Loon Lake Water and Power Company, successors to the old California Water & Mining Company, which has operated the water system on the Georgetown Divide for the last 40 years, is making extensive preparations for the building of large storage reservoirs and the erecting of hydro-electric power plants on this divide. The company has two offices in Georgetown, but the main work is being done about 25 miles east of here.

CANON CITY, COLO.—The Colorado Light & Power Company of Canon City have added a 1500 kw. Allis-Chalmers horizontal type steam turbine to their plant. It will utilize the exhaust steam from the two Corliss steam engines and thus the capacity of the plant will be doubled without adding more boilers. A. C. Ree of the Allis-Chalmers Company has made the installation. It was put in operation on September 28, 1910. A. C. Wallace is general manager of the plant.

MODESTO, CAL.—The Sierra and San Francisco Power Company, through its agent, W. L. McKinley, has spent the greater part of a week in South San Joaquin and Stanislaus counties securing rights of way from the main power line on the J. F. Miller land near Atlanta, south through Ripon, Salida and toward this city. It is the plan of the company to reduce from 100,000 to 15,000 volts and carry the power southward on a pole line. The line will be built immediately on the securing of the complete right of way. There will be a line from the substation westward to the town of Menteca.

PETALUMA, CAL.—The Petaluma Power & Water Company has resumed work on the enlargement of its storage reservoir on the Lawler ranch on Sonoma mountains east of this city, on which the company has already spent many thousands of dollars. The big dam is to be raised and the bottom of the lake, lowered, thereby greatly increasing the capacity of the reservoir. This makes the third consecutive year in which work on the enlargement of the reservoir has been carried on. The contract with an Oakland firm calls for the excavation of 25,000 cubic yards of dirt.

TOWNSEND, WASH.—From present indications the Elworth river in Clallam county will soon furnish electric power for manufactories in both Clallam and Jefferson counties. It is the intention of the company to transmit electric power to all points in Clallam and Jefferson counties. Mr. Aldwell, who is the leading spirit in the enterprise, is now signing contracts to supply power in the section and has signed contracts with the Western Steel Corporation to furnish their steel plant at Irondale with electric power sufficient to operate all of its machinery and the additional machinery the company contemplates installing in the near future. The company will soon commence the construction of their power plant.

OAKLAND, CAL.—Work has been started on the construction of a new subsidiary power plant in the West Oakland yards of the Southern Pacific Company for use in connection with the company's project of electricizing its Oakland and Alameda local lines. The new structure is being erected at the point where the Oakland mole lines join the inlet to the yards, and will be used as a step-down station for the high-power tension wires from the Fruitvale powerhouse. The new plant is 90 feet in length, and 60 feet in width. When completed, and equipped with machinery, which is to be of the most modern type, it will have cost approximately $100,000. The plant will be completed in March or April of next year.

TRANSPORTATION.

PORTLAND, ORE.—Work is be started on the Mt. Hood railroad from Gresham to Bull Run at once. Material is being assembled.

SEATTLE, WASH.—The injunction presented by the Puget Mill Company as against the electrification of the Madison line will be denied by the court, and work of electrifying will probably proceed.

SEATTLE, WASH.—J. B. Murphy, president of the Seattle Tacoma Short Line Company, has announced that a contract has been let for clearing the right of way between Youngstown and Buren Lake. The line between Seattle and Tacoma is expected to be in operation in two years.

EL PASO, TEXAS.—Golosk Hill and Franklin Hutts, who have asked for an extension of the Arizona street car line service, will not get the service, the Council, accepting the report of the street and grade committees, denying the petition.

DENVER, COLO.—The Denver City Tramway Company, John Evans, chief engineer, is said to be planning to enter the interurban field, acquiring the Denver, Greeley & Northwestern R. R., which has been inert for several years, and when the line is completed it will probably be extended to Boulder.

OAKLAND, CAL.—Within four months all street cars in Oakland will be equipped with fenders in accordance with the fender ordinance which was given its final passage at the meeting of the City Council last week. The ordinance will go into effect in 30 days, and the Oakland Traction Company is given 90 days after that date to meet with the requirements.

STOCKTON, CAL.—The Central California Traction Company and the American River Electric Company have just entered into a contract with the Stockton Investment Company, the owners of the new hotel building, whereby the firms have secured a long lease of the western corner of the structure.

SAN RAFAEL, CAL.—The City Trustees have passed an ordinance asking for bids for a street railway franchise in this city. Bids will be received up to the 20th of November. The franchise is liberal in its terms, and provides for a road of great scenic beauty, touching a growing territory of over 14,000 people.

SALEM, ORE.—Uppn the promise of the Oregon Electric Railway Company to build a board walk and install electric lights connecting its depot with that of the Southern Pacific Company at Tualatin, the railroad commission has withdrawn its order made a week or so ago, declaring that the Oregon Electric and Southern Pacific Company should be compelled to build a union depot at Tualatin.

STOCKTON, CAL.—The San Joaquin Valley Electric Railway Company, commonly known as the Brackett road, now has ten miles of roadbed completed. One mile north of Manteca, at the J. Walter Graves ranch, the construction camp has been located. This winter track laying will begin. Morris L. Brackett announces that within seven months the entire line will be completed from Stockton to Modesto and cars will be in operation. The new line will be operated by a third-rail system.

MEXICO CITY, MEXICO.—A concession has been granted the Mexico Tramways Company to construct an electric railway between Santa Fe, a suburb of this city, and Toluca, in the State of Mexico. The line will be 32 miles long. For a period of five years the company will have the free importation of materials which will enter into the construction. The concession provides that the main offices of the company shall be in Mexico City. The passenger tariff provides charges as follows: First class, 3 cents gold; second class, 2¼ cents; third class, 1½ cents per kilometer, with the minimum charge of 5 cents.

DENVER, COLO.—The Automatic Transportation Company of Buffalo, N. Y., is reported to have completed arrangements to build an elevated automatic railroad in Summit county, Colorado. The road is to cost $200,000 and it will be used to transport ores in the mountain districts and will be operated by electricity. The road will be built on steel trusses elevated above the snow line on piers, and will resemble the elevated system of large eastern cities. The road will be twelve miles long and will run from Keystone to Montezuma and Argentine. It will connect with the Colorado & Southern for Denver and Leadville at Keystone and with an extension of the Argentine Central at the east end. The company proposes to have it completed and ready for operation early next spring.

LOS ANGELES, CAL. — Six hundred men are now employed by the Los Angeles-Pacific Railroad Company in relaying and repaving the tracks on Sunset boulevard, beginning a series of improvements in the road which will involve the expenditure of $500,000. Fifty modern high-power interurban cars will be installed on the line, beginning a ten-minute service to Hollywood, on which commutation tickets will be sold at 5 cents a trip. These improvements, for which the contracts have already been let, are announced by Paul Shoup, director of all electric properties of the Southern Pacific Company on the Pacific Coast. Contracts have already been let for the reconstruction of the entire Sunset boulevard line. This means that the company is to expend $500,000 in reorganizing its service. The old rails will be replaced with heavy steel rails of superior quality. The roadbed will be altered and strengthened and the entire line repaved. Steel for the rails has already been shipped.

ILLUMINATION.

LIBBY, MONT.—This place is to spend $100,000 for waterworks, electric lights and telephones.

SEATTLE, WASH.—A contract has been let to the Novelty Incandescent Lamp Company for $60,000 worth of incandescent lamps for the city lighting department.

SAN JOSE, CAL.—A petition has been presented by the Pacific Gas & Electric Company asking permission to install steel towers with concrete base along Guadalupe creek.

TRINIDAD, WASH.—The Entiat Power Company proposes to bring power here to furnish light and power for the irrigation plants on the river. The line will be extended to Ephrata.

ALBANY, ORE.—P. G. Roe, an Eastern man, has presented to the Council the matter of a gas franchise in Albany and a special meeting of the Council will be held to consider an ordinance.

BENSON, ARIZ.—J. E. Collins of Tucson, representing an independent company, states that Benson will be lighted by electricity within 60 days. A 60 kilowatt machine will be installed and two engines.

SPOKANE, WASH.—The Spokane Falls Gas & Light Company will lay mains and make other improvements to the service. The Cannon Hill district is to be supplied. The cost is estimated at about $3500.

FARMINGTON, N. M.—The electric light plant has been purchased by R. W. Kowles and associates. They have signed a contract for the enlargement and use of the Star ditch and will spend about $100,000 in improvements.

UPLAND, CAL.—An ordinance has been adopted granting to the Pacific Light & Power Corporation a franchise for 50 years to erect poles and string wires for the transmission of electricity along the easterly side of Orange Grove avenue.

SANTA BARBARA, CAL.—The Santa Barbara Gas & Electric Company has started work for a high tension 10,000 volt line from the power station on Castillo street to the substation in Montecito, which will cost $10,000. As soon as a site for a substation is decided a concrete station house will be built.

LOS ANGELES, CAL.—A great stride for developing the San Joaquin Valley has been taken by the San Joaquin Light and Power Corporation, of which W. G. Kerckhoff is president, by the completion of a trust deed and mortgages for $25,000,000 with the Trust Company of America, a New York concern, which will retire outstanding bonds of the company and furnish funds for developing of Mariposa, Merced, Fresno, Madera, Tulare, Kern and Kings counties. After the retirement of old issue, there will be issued at once $1,500,000 6 per cent bonds for the completion of the San Joaquin power plant and for finishing the Bakersfield steam plant. A system of high tension lines will also be run.

TELEPHONE AND TELEGRAPH.

GRANDVIEW, WASH.—Benton Independent Telephone Company has started improvements here.

SUMPTER, ORE.—C. E. Porter, district manager of the Pacific Telephone & Telegraph Company, will shortly start the building of a phone line from Austin to Canyon City.

LEWISTON, IDAHO.—The Interstate Telephone Company has submitted a proposal to the Commercial Club to extend its line to Lewiston from a point in Spokane county near Spokane, the project to cost about $100,000.

VANCOUVER, B. C.—The Dominion Government has given orders for the construction of a government telegraph line between Prince Rupert and Stewart, B. C. Superintendent Phelan shortly goes north to direct actual stringing of wire.

WATERWORKS.

MEDFORD, ORE.—The Council has voted to ask for bids for the construction of the city's water system, for which $30,000 bonds were voted last spring.

VENTURA, CAL.—Work has commenced on the underground water system to supply Ventura with water by the Ventura Power Company. A great dam is under construction.

BEND, WASH.—A franchise has been granted John Steidl and Thomas Sweet for furnishing water for domestic and irrigating purposes in the unincorporated towns of Lytle and Riverside counties.

JACKSONVILLE, ORE.—The Council has approved the approved the water system plans of Engineer Osgood and ordered the recorder to advertise for bids for construction. The bidder is to furnish all material and labor.

HUNTERS, WASH.—M. W. Thompson has secured a water right on the upper Hunters Falls and has leased a power site from J. B. Cameron. Mr. Thompson recently purchased the light plant here and will transfer it to the falls.

NORTH BEND, WASH.—The Council has passed an ordinance providing for the securing of necessary property for the right of way and site for a pipe line and reservoir to furnish the town with adequate water supply. A franchise for such system has been granted H. Rief.

PROSSER, WASH.—The Department of the Interior, U. S. Reclamation Service, Washington, D. C., Frank Pierce, acting secretary, will receive bids until 2 p. m., November 1, for the construction of canals, wood stave pipe and other structures in the vicinity of Prosser, Wash.

SPOKANE, WASH.—Plans for a new pumping station at the Lincoln Heights reservoir, to take the place of the present Grand Avenue and Fourteenth Avenue pumping station, are being prepared by the water department. The estimated cost of the new plant is about $8000. A 3,000,000 gallon centrifugal pump will be put in at the new plant.

TURLOCK, CAL.—Bids will be received until 11 a. m. October 24, by the board of directors of the Turlock Irrigation District, at the office of the board at Turlock, Cal., for the construction of that portion of the canal and works of said district including one diverting gate, four drops and about four miles of canal in earth on the lower extension of Lateral No. 3 of the Turlock Irrigation District, all of which is more definitely described in the special specifications on file in the office of the board of directors in the city of Turlock, Cal.

SAN FRANCISCO, CAL.—The Board of Public Works has awarded to Foster & Vogt the contract for hauling and laying the pipe for that district of the auxiliary water supply system bounded by Van Ness avenue, Market and Powell streets, and the bay, the accepted bid being $102,809. The contract for the construction of the Peabody school went to McSheehy Bros., who had offered to do the work for $51,800. All the bids submitted on a former occasion had been rejected as too high, the lowest then received being $1300 above that now accepted from the McSheehys.

OAKLAND, CAL.—The Bay Cities Water Company will commence work at once on its $5,000,000 distribution system for Oakland, Alameda and Berkeley. A large force of men will be put to work in Melrose putting down 12, 10, 8 and 6-inch fire mains and 4-inch domestic supply pipes. The system will consist of a 6-inch main on Forty-seventh avenue and a cross system of 4-inch pipe running west from Forty-seventh avenue to High street, where all mains will be connected with a 12-inch main running along High street. The rest of the supply and domestic mains will be of 4, 6 and 8-inch pipe with no dead ends and with a full supply of water at all times.